

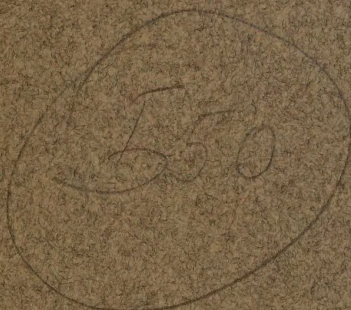
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THE EMERYVILLE SHELLMOUND
FINAL REPORT

BY
W. EGBERT SCHENCK

UNIVERSITY OF CALIFORNIA PUBLICATIONS IN AMERICAN ARCHAEOLOGY
AND ETHNOLOGY

Volume 23, No. 3, pp. 147-282, plates 35-54, 8 figures in text, 1 map



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PREFACE

For perhaps seventy-five years a number of artificial shellmounds scattered along the shore line of San Francisco bay have excited the curiosity of the incoming white settlers. As long as fifty years ago collections were being made of the aboriginal relics found on their surfaces or turned out by the plow.¹ In the spring of 1902 Professor John C. Merriam and Dr. Max Uhle of the University of California first directed scientific attention to these mounds, making careful excavations at the Emeryville site and publishing methodical considerations of the evidence obtained.² During the years 1906-08 N. C. Nelson made a detailed study and report on the Ellis landing mound;³ and in 1908 he completed a survey of the entire San Francisco bay region, located, numbered, and mapped the mounds, analyzed them in detail and published a summary of his observations and conclusions.⁴ This work disclosed nearly 400 of these shell-heaps and established the fact that they were of the same general nature as the "kitchen-middens" of other countries. In 1913 E. W. Gifford made a series of laboratory analyses to determine the constituents of the mounds.⁵ In 1915 L. L. Loud reported on the mound at Stege.⁶ Other field work was done which has not yet been reported.⁷ In 1924 one of the most conspicuous of the mounds, situated in Emeryville (No. 309), was leveled in order to convert the area into a factory site. This destruction presented an opportunity for the collection of fresh data which the University was enabled to embrace. The main purpose of the present paper is to present these data.

¹ Thompson and West; *Historical atlas of Alameda County*, 15, 1878.

² The Emeryville shellmound, present series, vii, 1907.

³ The Ellis landing shellmound, present series, vii, no. 5, 1910.

⁴ Shellmounds of the San Francisco bay region, present series, vii, no. 4, 1909.

⁵ Composition of California shellmounds, present series, xii, no. 1, 1916.

⁶ The Stege mounds at Richmond, California, present series, xvii, no. 6, 1924.

⁷ 1902. E. L. Furlong acquired specimens for the University from the West Berkeley mound.

1906. N. C. Nelson, S. A. Barrett, P. E. Goddard, and A. V. Wepfer under the direction of Professor John C. Merriam dug a pit and obtained specimens from the Emeryville mound.

1908-1912. N. C. Nelson made excavations in divers mounds about the bay. A number of specimens were obtained but his report has never been written.

1911. L. L. Loud excavated and studied a mound (No. 356) near the southern end of San Francisco bay but has not yet published the result of his labors.

1913. L. L. Loud did the same for a mound at Glen Cove near Benicia on Carquinez strait at the northeastern end of the San Francisco bay region.

The new studies fall into two divisions. First, the removal by steam shovel of the upper portion of the mound was utilized for observations and the gathering of skeletal and artifact material exposed. Second, after the conclusion of the leveling operations, controlled excavations were made by hand in the undisturbed lower levels. These excavations were rendered possible by the generosity of Mr. P. E. Bowles.

The steam shovel work at Emeryville offered one great advantage. The large volume of material handled and the disclosure of cross-sections of the entire mound enabled us to secure a comprehensive view denied by the narrow horizons incident to limited excavations. We were struck by the check which this broad view gave on conclusions suggested by our own hand work, and which led us to regard with great caution comparisons with work done at different places by different methods. Hence in giving our conclusions frequent reference is made to the work of Uhle, Nelson, Gifford, and Loud so that the reader may conveniently weigh the evidence and check our assertions. In some cases where such citations differ from our own conclusions considerable discussion has been indulged in. It is hoped that this will not appear unduly contentious or obscure the feeling of obligation and respect which the author feels for previous workers.

Several considerations have governed us in comparing the findings at Emeryville with those of other areas. It seemed best to make no attempt to go beyond the borders of California. Within these limits the material available for such comparisons is limited mostly to San Francisco bay itself and to the Santa Barbara region. Other material exists but in order to be used it would have to be worked up somewhat along the present lines and it seemed unreasonable to delay the present paper until such work could be done. Hence while a consistent attempt has been made to compare Emeryville with other San Francisco bay mounds which have been worked, our comparisons with other areas are limited to the facts which happened to be familiar to us as we wrote.

It is in an endeavor to make such regional comparisons easier in the future that we have developed and described so fully as many types as possible, that we have sometimes used material inadequate in quantity, and have indulged in conjectures based thereon. A *casual* survey would establish the shellmound culture as ranking very low in the cultural scale. Hence the value of its study seems to lie in the possibility of tracing relationships through regional comparisons. Uhle's work reflects the awakening of the anthropologists of his time to the

remoteness of man's beginnings. Nelson is influenced by the dawning importance of the stratification of human deposits.

Some justification for our liberal indulgence in speculation seems necessary. Partly this is to offset previous speculations, but most largely it is due to our belief that speculative hypotheses furnish one of the most stimulating guides for the acquiring and testing of evidence and the arranging of it into its true position in the scheme of things.

The Department of Anthropology is under particular obligation to Mr. P. E. Bowles, of Oakland. His generous financial patronage rendered our intensive work possible. Mr. John Hubert Mee, president of the Mee Estate, thoughtfully made known to the University his intentions concerning the property on which the mound is located, permitted us to use the land as we desired, and furnished interesting information. Mr. Charles Claudius, in charge of the leveling work for the Pacific States Construction Co., did everything in his power to help us secure the maximum of scientific data, furnished us with maps and surveying data, and lent much equipment for our work. Mr. Sayler, of the adjacent Sherwin-Williams sulphur plant, supplied us with steam and tools. Many persons whose names are unknown secured and turned over to us specimens that would otherwise have been lost.

The author especially appreciates the guidance and assistance given him by Dr. A. L. Kroeber and Mr. E. W. Gifford of the Department of Anthropology. Mr. L. L. Loud, of the Museum of Anthropology of the University, was his untiring and able assistant in the field. Members of the Department of Geological Sciences of the University, especially Dr. George D. Louderback, kindly assisted with the geological points involved, as did Dr. Warren D. Smith, of the Department of Geology, of the University of Oregon, and Mr. Hubert G. Schenck, Associate in Paleontology, in Leland Stanford Jr. University. To Miss Edna Fisher, Assistant Curator of Osteology of the Museum of Vertebrate Zoology of the University of California, we owe our identification of the animal remains recovered.

GEOGRAPHY OF THE MOUND

LOCATION

The Emeryville shellmound was situated a little north of latitude $37^{\circ} 50' N$ and somewhat east of longitude $122^{\circ} 18' W$ on the eastern shore of San Francisco bay, almost due east of the Golden Gate (fig. 1). It lay in Emeryville, a civic incorporation between the cities of Oakland and Berkeley, Alameda County, California; on ground officially described as the western portion of Plot No. 7 of the Kellersberger Survey of the Peralta Grant;⁸ and between the bay and the Southern Pacific Company's railway tracks and between the Shellmound Park and Shellmound Tower stations of that line. Nearer the last-named station and westerly across the tracks from it the southerly property line of the sulphur plant of the Sherwin-Williams Paint Co. intersects the westerly property line of the Southern Pacific Company's right of way (A, pl. 35). Thence southerly along the Southern Pacific right of way line (AC) 125 feet and then westerly at right angles 100 feet lies the point which hereinafter will be called the center of the mound (M, pl. 35).⁹

ENVIRONS

In discussing the situation of this spot our desire is to note those features of a permanent nature and as far as possible to reconstruct the aboriginal environment (fig. 1).

The situation is on an alluvial plain which stretches from north to south along the entire eastern shore of San Francisco bay with an average width of some three or four miles. After this distance it passes sharply into the steep slopes of the Berkeley and San Leandro hills of the Coast Range mountains. The maximum elevation attained by these hills is about 1800 feet. On the south this plain merges imperceptibly into an extensive area now known as the Santa Clara valley.

⁸ Being part of a Spanish grant the area has never been laid out in townships, ranges, and sections.

⁹ It will of course be understood that there was nothing on the ground to mark this point. Further, no idea of mass is implied, i.e., it has nothing to do with the center of gravity. In any horizontal plane it is the point perpendicularly under the supposed apex of the mound.

The center according to Uhle's map (*loc. cit.*, pl. 37) does not coincide with ours. Our map is based on the survey made by the Pacific States Construction Co. Both probably approximate the truth and the discrepancy would not invalidate any conclusion drawn herein.

On the north after meandering the shores of San Pablo bay it is obstructed by the hills. However, at no place do these hills offer any real obstacle to travel and after a two or three days' march a good walker will debouch upon the vast interior plain of California, the San Joaquin valley.

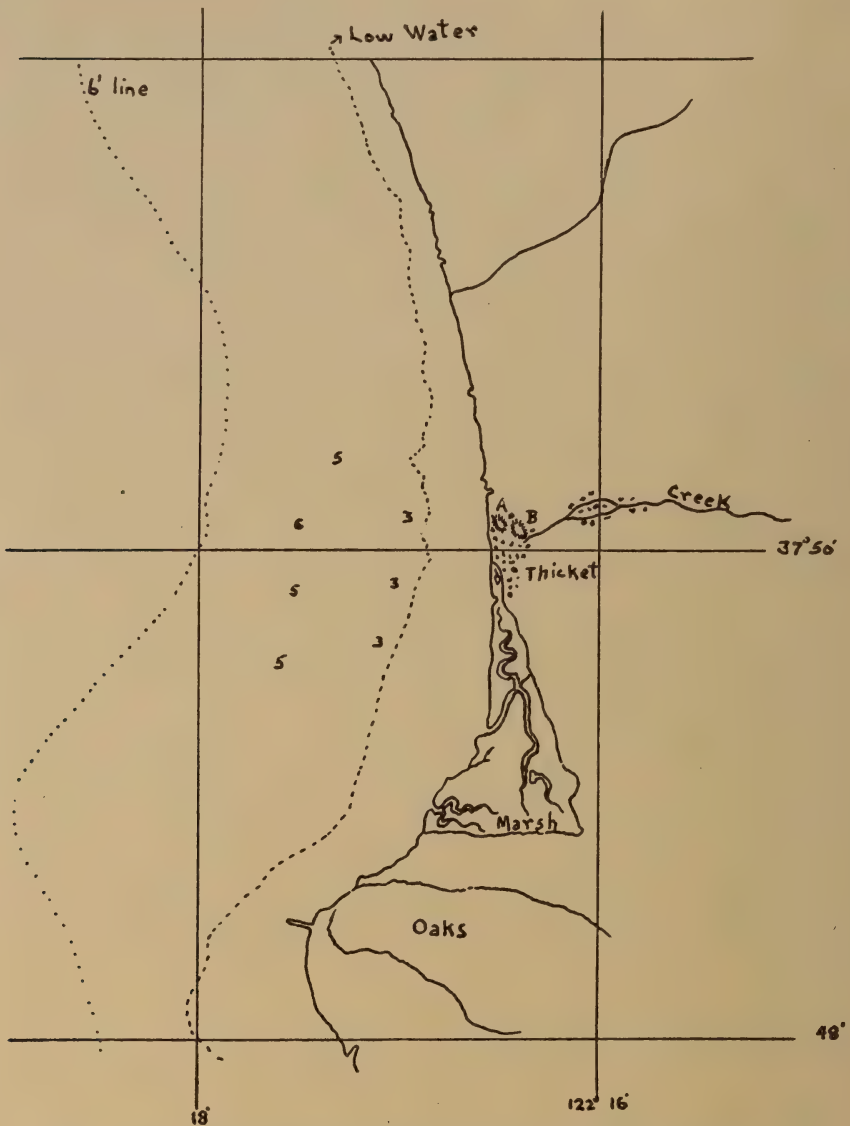


Fig. 1. Main geographical features of the Emeryville shellmound. "A" is the western cone dealt with as "the mound." (Based on U. S. Coast and Geodetic Survey of 1859.)

Returning to our particular locality we find that under fair weather conditions the details of the bay and the Berkeley hills are strikingly visible. And in an hour's walk one can attain an elevation on those hills whence the entire bay regions appears as a map. In other words, anyone living in such a situation must certainly have had a fair knowledge of the surrounding country—its groves, streams, settlements, etc.

On the east, in 1924, the mound was bounded by the railway tracks above mentioned. When these tracks were laid a portion of the mound was cut away and twenty or so burials were unearthed. Just across the tracks, farther east, were formerly other "mounds" which were leveled to make a race track, revealing burials and artifacts when the work was done. Beyond this the plain, treeless except for the stream courses where there were buckeyes, willows, etc., extended to the hills.

The information on these other "mounds" is conflicting. "Old timers" told the writer that there were two large mounds just east of the tracks. Others said that there was only one but that it was larger than the present mound. The Coast Survey map of 1859¹⁰ and that of 1915¹¹ both show two connected mounds. An old history of Alameda county¹² prints a picture of the residence of Mr. J. S. Emery (at the present corner of San Pablo avenue and Forty-fifth street) which, in the background, shows the race track (for which at least one mound had probably been leveled), the present mound with shrubbery, windmills, and a tank or pavilion thereon, and also two other mounds (southwest toward the bay) connected with it. This makes four in all. Nelson¹³ numbers this site 309 on his map and plots one large and two small mounds "still present," and two large mounds "disappeared." From all this it seems certain that several cones were formerly visible on this site.

But from the evidence on the ground as well as from the stories and maps it is also clear that at least two of the larger cones were connected. These data point to the existence on the site not of a number of isolated "mounds" but of a single, widespread, perhaps rather thin mass of mound material from which there arose a number of cones of the same material. In figure 2 the elements of this conception are presented. No data exist which enable us to divide this mass accurately into definitely separate entities, either horizontally as by cones or vertically as strata. To avoid confusion we will follow precedent and use the terms "mound," "Emeryville shellmound," etc.; but whereas in previous discussions those were meant to designate a distinct and separate unit our conception is that only a portion of the whole is being dealt with and in our use of the terms we cover only the western cone (cone A, fig. 2). This distinction is of importance when we come to consider the origin and growth of the mound.

¹⁰ U. S. Coast and Geodetic Survey map, Entrance to San Francisco Bay, 1859.

¹¹ U. S. Coast and Geodetic Survey map, San Francisco Entrance, No. 5532, 1915.

¹² Thompson and West, *Historical Atlas of Alameda County*, 9, 1878.

¹³ *Shellmounds of the San Francisco bay region*, present series, VII, no. 4, 1909, map 1.

Flowing in from the east and passing south of the mound was a small creek, called on present maps Temescal creek. Its nearest point was about 450 feet southeast of the center of the mound (M) and it discharged into the bay some 800 feet southwest of the center. This creek seems to be the determining physiographical feature of the location. In the first place, it would have tended to focus population by furnishing a supply of fresh water. At the present time its flow is not natural since it was dammed in the hills in 1866 to form Temescal lake. It has a drainage area of six square miles and in 1866 it was the principal water supply for the several thousand inhabitants of Oakland.¹⁴ In the second place, it must have been of importance as a source of food. Within the memory of men living nearby it has had salmon runs. And Mr. P. E. Bowles informs me that in the early 1880's it was a favorite resort for amateur fishermen. Farther on, the creek overflowed producing marshy ground in which was a more luxuriant plant growth and which must have furnished coverts for game. Just east of the mound was a considerable area of this kind (fig. 1). Finally, forming a bar at its mouth in the bay, it directed the cut and fill of the current of the Sacramento river which flows very definitely through the bay hugging this shore. Within the past fifty years much of this bar has been removed and the wash from the hills has been decreased because of human settlements. In the same period the river current has cut in, bringing the shore line farther east as is discussed below.

South of the creek was a "willow thicket" some 20 acres in extent which probably furnished a convenient and ample supply of firewood. Farther south (fig. 1) the thicket merged into a marsh extending about one and a half miles along the shore and gradually increasing in width until at its southern end it was three-quarters of a mile wide. Beyond this was a mile of rolling highland supporting a beautiful growth of oaks which reached eastward to the hills and which gave Oakland its name. These furnished an important source of food and no aboriginal settlement seems to have existed nearer to them than the Emeryville mound.

West of the mound is San Francisco bay. In 1924 the shore line was 220 feet from the center of the mound (fig. 2). In 1902, Uhle's map¹⁵ shows it was 260 feet. Uhle further states¹⁶ that in 1877 it was about 300 feet. In other words, the shore line is working eastward at

¹⁴ M. W. Wood, *History of Alameda county*, 650 *et seq.*, 1883.

¹⁵ *Op. cit.*, pl. 3.

¹⁶ *Op. cit.*, 3.

the rate of about 150 feet a century. Such cutting may not have been going on for a century but only since modern conditions have prevented the wash from the hills balancing the cutting. However, the 1859 Coast Survey map shows the 6-foot depth line (fig. 1) farther west—not only opposite the mound but north of it—than in 1915. This would indicate that the cutting was largely independent of the creek.

Low tide left a quarter of a mile of beach exposed. This was true even at the creek mouth. Hence boats or rafts could have been beached or brought into the safe port of the creek only at high water. Beyond the low tide line it was another mile before a man was over his head at low tide. Within the memory of nearby residents this was a fine clean beach of white sand containing shellfish.

North of the mound the plain was not marshy, supported few trees, and had few streams. A small creek falls into the sea about 3300 feet north of Temescal, and in another 3300 feet is a second small creek. The mouth of Strawberry creek in West Berkeley, where there was another mound, is 5600 feet north. Thence northward the shore was more marshy with a creek parallel to the shore. About four miles beyond Strawberry creek, Stege with its mound was reached, and in another mile the Ellis Landing mound; from which it will be seen that aboriginal settlements were reasonably close together in this direction.

HISTORICAL DATA

The first recorded traveler to pass along the eastern shore of San Francisco bay was the Spaniard Pedro Fages in 1772.¹⁷ He reports much game—deer and bear, but no Indians. Since he does mention them at the southern end of the bay and again at the northern end, as do also the two succeeding explorers, Anza and Moraga, and since the weather was such that he plainly saw the Golden Gate it seems incredible to the author that any people could have been residing at the time in the present vicinity of Oakland-Berkeley. However, when Commander Ayala explored the bay by water in 1775 he mentions meeting a number of Indians on balsas.¹⁸ Following these brief mentions we have little historical data pertaining to our site until we reach the modern history of Oakland. The land on which Oakland stood was granted by the King of Spain to Luiz Maria Peralta in 1820. He

¹⁷ H. H. Bancroft, *The native races of the Pacific states*, II, 595, 1886.

¹⁸ H. H. Bancroft, *History of California*, I, 246-247, 1884.

divided his grant among his five sons and Vincente Peralta obtained the portion in which we are at present interested. Vincente established his residence near Temescal creek about one and a half miles east of the mound (near the point where the present Telegraph avenue crosses the creek, i.e., at Vernon street). This region became known as the Mexican village of Temescal.¹⁹ Now Uhle deduces from the name Temescal the existence of an aboriginal settlement.²⁰ But it seems to the author just as likely that the name arose from the Vincente Peralta establishment. Among his retainers would be Indians or others using the sweat bath and it is likely that they would establish a sweat house (temescal) near their houses on the creek, whence the creek would receive its name. The supposed name first appears on the 1857 Kellesberger Survey map as "Temescouta" which may or may not be Temescal.

In 1857 Kellesberger made his survey of the Peralta grant and in 1859 Edward Wiard²¹ bought the plot on which the shellmound stands. Maps of that date show buildings on both mounds. In 1871 he leveled at least a portion of the easterly mound and established a mile race track known as the Oakland Trotting Park. In 1876 he opened a holiday resort and picnic grounds known as Shellmound Park. "It derives its name from one of the ancient Indian shellmounds which . . . rises to a height of 60'. Its summit being crowned with a dancing pavilion."²² It was doubtless due to its inclusion in this park that the mound was so long preserved practically intact. It is doubtful that the mound was ever 60 feet high though an indeterminate amount of its top was cut off to provide the level plateau for the pavilion. In 1879 the park was leased to Captain Ludwig Seibe, who held the lease until the destruction of the mound in 1924. In the meantime James Mee acquired the property from Wiard in 1886 and passed it to the Mee Estate in 1906.²³ Its subsequent history we have indicated in the introduction.

¹⁹ M. W. Wood, *History of Alameda county*, 652, 807-808, 1883.

²⁰ *Op. cit.*, 5.

²¹ M. W. Wood, *History of Alameda county*, 996, 1883.

²² M. W. Wood, *History of Alameda county*, 807, 1883.

²³ Letter from John Hubert Mee dated November 22, 1924.

TOPOGRAPHY OF THE MOUND

When Uhle abandoned the mound in 1902 it was surmounted by a pavilion surrounded by a cypress hedge.²⁴ By 1924 both of these had been destroyed. The cut by the Northern Railroad (now Southern Pacific Company) had destroyed the natural contours on the east. On

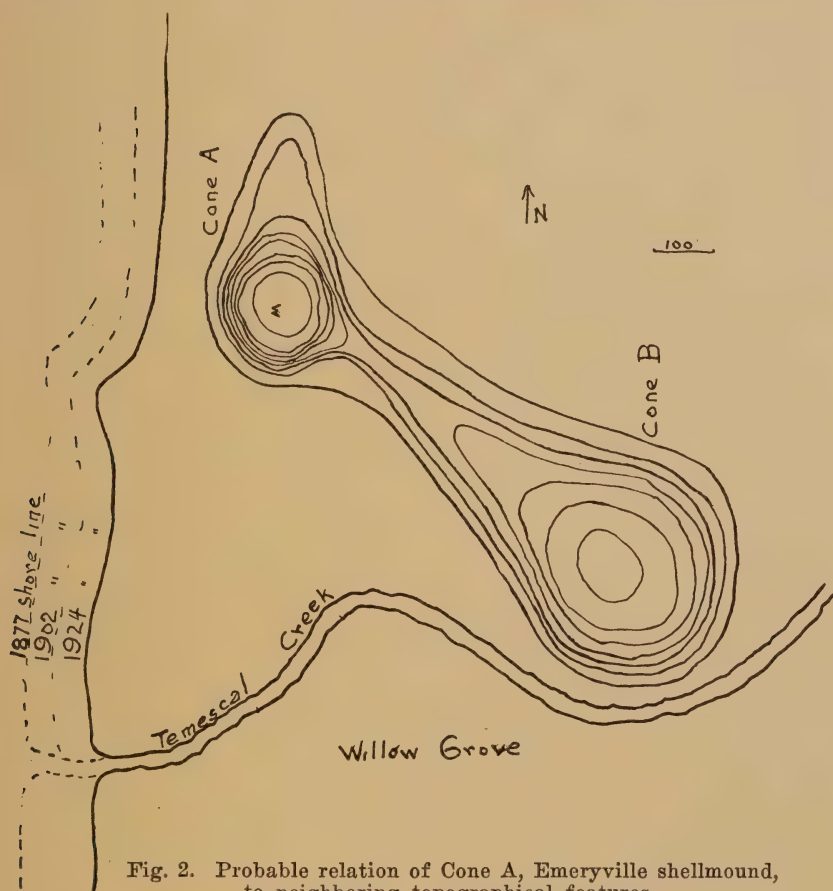


Fig. 2. Probable relation of Cone A, Emeryville shellmound, to neighboring topographical features.

the north a factory and a tank had been erected. This work had disclosed burials but had obliterated the northern projection of the mound (fig. 2). On the west between the mound and the bay a concrete road had been built. A portion of the mound had been used for the purpose and this further confused the contours. Even with these disfigurements the mound presented itself as a fairly symmetrical truncated cone with steeply sloping sides (pl. 36).

DATUM POINTS

With reference to datum points it would be simplest to follow Uhle except that he nowhere definitely states his bases but uses such terms as the "level of the plain." Moreover his maps²⁵ and his text employ as synonymous such radically different terms (see below) as "shore line," "sea level," "level of high tide," "level of the bay," "general tide level of the bay," etc. Therefore for heights we have adopted the Southern Pacific Company's system wherein zero, known as "C. P. datum" is apparently an arbitrary point. Combining the railway data with those obtainable from the Coast Survey Chart 5532, 1915, the elevation of the following points can be set down, all relating to San Francisco bay.

—1.733 feet	Lowest tide
0.	C. P. datum
+0.767 feet	Coast and Geodetic Survey datum (mean lower low tide)
1.867 feet	Mean low tide
3.667 feet	Mean level of the bay at North Point
5.567 feet	Mean high tide
7.367 feet	Mean higher high tide (Oakland)
9.+ feet	Highest tide = shore line

Since both Uhle and Nelson have drawn important conclusions based on "sea level," it seems desirable to explain this schedule in detail. In San Francisco bay, one high tide is radically different from the other high tide of the same twenty-four hours. The low tides likewise differ. In other words, there is a higher high tide, a high tide, a low tide, and a lower low tide. All these tides vary with the seasons. The very lowest water observed fell 1.733 feet below datum. But the average of the lower low tides (used as datum by the coast survey) rose .767 feet above our datum. "Mean low tide," 1.867 feet, is the average of all low and lower low tides for a year, 3.667 feet being the average of *all* tides at a point near the open sea (North point), would come nearest to our ordinary conception of "sea level" or to Uhle's "general tide level of the bay." "Mean high tide," 5.567 feet is the average height of the lower of the two daily high tides, while the higher high tide averages 7.367 feet. But the highest seasonal tides would rise beyond this and mark the shore line which according to the Pacific States Construction Company's figures was somewhat over 9 feet opposite the shellmound.

In this paper heights will be referred to in terms of elevation above C. P. datum, *not* above any tide mark. For example: the concrete road west of the mound is 11 feet elevation, and the top of the rails of the Southern Pacific tracks 14.2 feet elevation, meaning that they are

²⁴ *Op. cit.*, pl. 2.

²⁵ *Op. cit.*, pl. 4.

11 feet and 14.2 feet respectively above C. P. datum, or 2 feet and 5.2 feet above the very highest water.

For horizontal locations our datum will be the "center of the mound" previously 'tied in' with the Southern Pacific railway right of way.

HEIGHT

The highest point of the mound in 1924 had an elevation of 38.8 feet; the lowest point an elevation of 4 feet. This high point, however, is unfortunately not the original highest point, the top having been more or less leveled for the dance pavilion. If the cone had continued its slope to a definite point it might have attained an elevation of some 66 feet, which is not far from the height of 60 feet given by the county historian. This seems improbable. It is doubtful if Wiard would have undertaken the moving of a symmetrical cone containing some 7000 tons. There is not sufficient trace of such a bulk of material having been placed elsewhere. It would seem, therefore, that the maximum elevation attained by the mound was about 40 feet. The "level" top of the mound is uneven, ranging in elevation from 36 feet to 38.8 feet; hereafter we consider this plateau to be level with an elevation of 37 feet, which becomes a datum point in considering burials.

SHAPE AND SIZE

While the mound when first seen conveys the impression of a truncated cone (pl. 36) and while the 24-foot elevation to 37-foot elevation contour lines are remarkably uniform (pl. 35), a cone-shape for the entire mound with a determinable basal diameter does not seem so easily established. Viewing the top portion we see a truncated cone (pl. 35). Reconstructing the middle portion (elevations 12 to 24 feet) from data available we can at least disclose a very irregular figure (fig. 2). To support these we must hypothecate an even more irregular base.

The roughly circular plateau enclosed by the hedge (37 feet elevation) may be said to have an average diameter of 145 feet.

When we come to the next dimension we are confronted by the question: where is the base? Uhle²⁶ says the mound has "a diameter of 270 feet at its base" which we determine from his map (pl. 3) to be about 8 feet above "shore line." But a little farther on²⁷ he speaks

²⁶ *Op. cit.*, 3.

²⁷ *Op. cit.*, 11.

of "the base of the mound two feet below the water level" and from his plate 4 we determine the diameter to be some 354 feet at that point. The base might be taken as the plane where the slope of the mound at present definitely rises from the slope of the plain which Uhle judged to be about 8 feet (probably our 17-foot elevation) above the shore line and which seemed to us to range from that figure down to 12 feet elevation. These facts, together with the fact that when the mound was leveled it was cut down to the 15-foot elevation line, leads us to denominate that contour as the base of the *cone*, but not the base of the mound. At this point the cone might be said to have a diameter of about 250 feet. The diameter cannot be stated exactly since grading work on adjacent property utterly destroyed the original contours which break abruptly at the fences marking the property lines (A B and A C, pl. 35). Our data do seem to point to the 15-foot elevation lines extending 100 feet farther north and possibly 800 feet farther east. When we drop to Uhle's "two feet below the water level" (possibly our (7-foot elevation) the mass constituting the base of the mound must at least attain that extent. At 16 feet elevation we unearthed burials 135 feet northwest of the center of the mound, and at 11 feet elevation we found a body 310 feet southeast of the center. Burials were disclosed in digging tank foundations at about 15 feet elevation, about 175 feet north of center. All of this confirms the older maps and reports, which extend the shell mass some 700 feet east of our center. In short, it seems to the writer that all idea of a circular basal perimeter to finish out the truncated cone must be dropped. What the exact shape was must remain uncertain but that shown in figure 2 seems as fair a guess as any. The area of the base is again a guess but it would appear likely that it might have been as much as 300,000 square feet and the cubic contents as much as 150,000 cubic yards.

To summarize: The mound when we began work on it (pl. 35) had been considerably distorted; we deal largely with an approximately conical section with diameters of 150 feet and 250 feet and a height of 22 feet containing, according to truck measurement as it was hauled away, 26,500 cubic yards; this section may not properly be projected into a larger cone with a circular base but is simply a portion of a very large and irregular mass.

RELATION TO SEA LEVEL

A series of twenty-two 9-inch holes sunk by us in the central portion of the mound established an average elevation of 6 feet for the lowest portion of the mound. The lowest was 4 feet elevation and the highest 7 feet elevation. These results seem to check reasonably close with Uhle's determination, which was apparently 7 feet elevation.

This places the base about 2 feet below the point attained by the highest tides at present, which is construed by Uhle²⁸ as a fact of major importance. He postulates therefrom a general subsidence of the area and a remote age for the mound.

As we see it, however, no such inference follows: The mound rests upon a stratum of yellow clay stained rather dark above probably by seepage from the mound and gradually becoming lighter in color and more sandy until at about 3 feet (under the central portion) it passes into a stratum of gravel. A well 150 feet or so to the north of the center indicates that these strata of clay and sand alternate to a depth of 300 feet, the first gravel stratum being 17 feet thick. Holes dug to the west of the mound below high tide line, by the contractor in canalizing Temescal creek, reveal the same clay. The surface of this clay would not have been absolutely even but must have presented slight rises or depressions which would account for the variation in our elevations of the bottom. Larger knolls may have occurred which were missed in our random digging. Farther on this clay plain slopes from the sea upward toward the east. Both Uhle's work and our work was confined to the western portion of the mass of shellmound material. Extending as this does 700 or 800 feet farther east it seems probable that the slope of the plain might carry its base a couple of feet higher in that distance. Now even our average base (6 feet elevation) is not below "sea level" but is just about at the level of the average high tide (fig. 3). It is 4 feet at least above average low tide. Granting that it would have been unlikely²⁹ for the aborigines to start a shell heap on the wide, hard³⁰ tide-flat exposed, it would still require but the slightest knoll or a very small gain from the general slope to afford a dry spot at all tides. Since the base is not below sea level, but only

²⁸ *Op. cit.*, 11-14.

²⁹ H. G. Schenck, Associate in Paleontology, Leland Stanford, Jr. University, informs me that he has seen "Indians in Chehalis county, Washington, that had shell heaps on tidal flats."

³⁰ At present, even with the sea cutting in, one can walk dry-shod a hundred feet or more west of the present shore line near the mouth of Temescal creek when the tide is out.

below high tide level, it may be recalled that the tides do not depend entirely on sea level but on bottom and shore configuration as well. For example, from the same sea level tides rise 3.5 feet higher at Alviso on the southern shore of San Francisco bay than they do at North Point. A change in the contours off shore from the mound might well cause enough change in the local tide to inundate the base of the mound or leave the place entirely dry. The entire present base of the mound need not have been dry land. All that was required was a foundation, whether a heap of shells formed at low tide or a small dry knoll. A settlement started here could spread the shell heap across tide-flats at

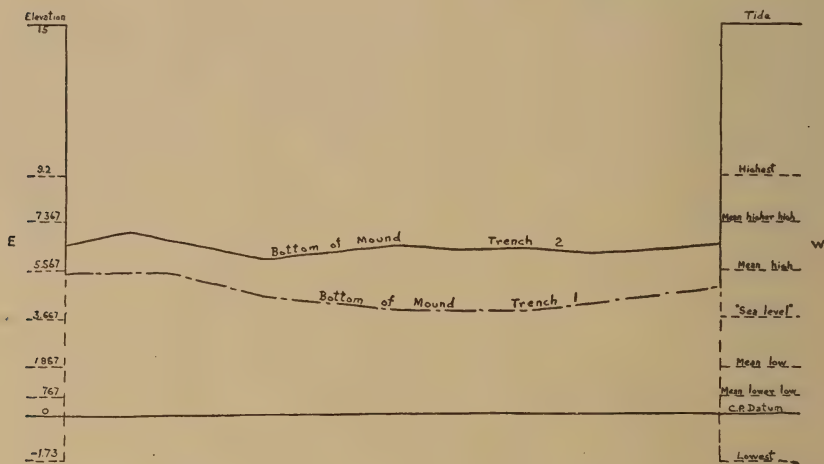


Fig. 3. Longitudinal cross-sections of trenches 1 and 2 showing bottom of mound material. Horizontal scale is twice the vertical scale.

low water, or into a marsh or the bay at high water. The need of pile dwellings in order that the foot of a mound might start below a high tide level seems utterly unnecessary. A shell heap once formed by thus "creeping" out into the water or a marsh from a higher nucleus may acquire deceptive characteristics. We dug at Emeryville during one of the wettest Februarys on record—and this month comes in the wet season and the season of highest tides. The flow of water into our pits was from the east and was fresh, indicating that it was due to the run-off from the rains. High or low tides made no perceptible difference and after a few dry days one could work, without being unduly troubled by water, at an elevation of six to seven feet. During the dry season of more than half of the year this condition must have been greatly emphasized. In other words, once a shell heap has been formed—in or out of water—the aborigines could just as well dig

pits in it for burial or residence below the water level as we could make dry-footed excavations to recover them.

Finally, while it seems that the facts of the base and foundation of the Emeryville mound may be reasonably explained without postulating subsidence, even if we postulate it we have little clue to age. General subsidence in this region is very obviously proved by San Francisco bay itself. But this subsidence was so remote as to have no bearing on the present discussion. As evidence of recent subsidence the shellmounds were always first cited to the author by geologists. Of these, the mounds at Emeryville and Stege seem at least open to argument. The only other mound intensively studied from this angle is that at Ellis landing where the base appears to be several feet below the spring shore line. The data then are not exhaustive. To take the mounds as evidence of subsidence and then subsidence as an indicator of the age of the mounds seems a roundabout manner of assumption. As far as the Emeryville mound is concerned it seems that the fact of geological subsidence since the mound's base was laid down is far from proved and that, if granted, the conclusion to be drawn is uncertain since the area is specified by geologists to be one of buckling, while this subsidence and elevation of contiguous limited areas is believed by them to have taken place in quite recent times.

Some consideration must also be given to the settling of an accumulated mass, such as the shellmound, in the silts of the bay. Where railway tracks were laid in the Sacramento delta region this settling was enormous. The substratum at Emeryville would not lead one to expect such settling, and Uhle decided against such a possibility.

METHOD AND EXTENT OF WORK

From October 17 to November 30, 1924, we watched the leveling of the mound by steam shovels. From January 19 to March 11, 1925, trenches were sunk by hand with the sole object of obtaining archaeological data.

In the prosecution of the leveling work scientific ends were secondary, and our methods had to be adapted as far as possible to the situation. The material was placed in trucks by steam shovels, hauled a short distance where it was dumped and spread by means of a Fresno scraper. About 750 cubic yards were handled by a shovel each eight-hour working day. On account of the nature of the mound no blasting was necessary. The shovel dug into it leaving a vertical wall about 22 feet high somewhat obscured at its foot by a talus accumulation.

Traversing this wall the shovel would undercut it, caving in the top ten feet or so. This was done with the bottom of the dipper open so that the loosened material would pour through. A single cave-in usually extended back 12 to 24 inches and in one traverse the shovel would make a cut 10 to 15 feet wide.

This method of the contractors offered advantages as well as disadvantages. The material was turned over pretty thoroughly and more or less exposed to view four times—in cutting from the wall, in dumping from shovel to truck, in dumping from truck to ground, in being spread by the scraper. We paid most attention to the mound itself but specimens were obtained in all the processes. All large objects were likely to be disclosed by this work and it is believed that the percentage of existing articles of this kind which were noted or recovered is high. Burials also were likely to be disclosed because the bones were different from the material in color and readily seen; and because a burial occupies so much space that it would be a rare exception for the shovel working with dipper closed to hit it so exactly that no trace would be observed. On the other hand, the lower levels were obscured partly because of the talus and partly because the shovel worked here for a greater portion of the time with the dipper closed. Infant burials were likely to be missed because of their small size. Since most of the burials were turned up in the direct work and path of the shovel, they could not be consistently examined for articles which might have been interred with them, although the larger part of all the small articles found, except bone awls, were found associated with burials. No doubt, then, we missed by far the greater number of small artifacts.³¹

³¹ Uhle found on the average 1 burial per 28 cubic yards. Our average in the shovel work was 1 in 40 cubic yards and in the trench work 1 in 7 cubic yards. Uhle's work and our trench work was done in areas where burials were thought to be most numerous. Our own work in particular excludes the unproductive perimeter of the mound, the volume of which is included in the steam shovel figures.

In the matter of artifacts comparisons are worthless since they are not based on the same standards. Uhle got one artifact in each 0.47 cubic yards of material handled. We counted, however, many bits of stone and bone similar to scores of pieces rejected by us. The next trouble arises from the uncertainty of the count. How many artifacts is a mortar with some olivella disc beads stuck thereon? On certain skulls such beads appeared to be inlaid. If one hundred are taken from a skull should one count one hundred artifacts? With one burial we secured over a thousand such beads. To count one thousand artifacts, making each bead equivalent to a mortar or charmstone, would be misleading. Yet if found one by one, here and there, how else could they be counted? From the cone we catalogued 675 entries, from the trenches 317 entries. Counting each bead the total is over 6300 artifacts. In the trenches we have one artifact in each 0.74 cubic yards; in the cone, one in 39 yards. For the whole work we show one artifact in 4.2 cubic yards. We emphasize that in our opinion such average figures are misleading rather than helpful.

It was frequently impossible to minutely examine structural features such as pockets of ash, etc. On the other hand, the scale of the work, exposing as it did a series of cross-sections 22 feet high of the entire mound, enabled a more comprehensive view to be had of layers, strata, etc., than could possibly be got from a small pit or trench. These features appeared more fully and in a more complete relation to other features. Since the shovel left each wall undisturbed for several days there was ample opportunity to study these grander features of structure. Depths were noted and recorded whenever possible. Unless a specimen was seen *in situ* no depth was taken. No original surface finds were made. Hence everything had some depth, but where it was not found in place it was recorded as "surface." Most depths had to be estimated by eye, but this was done with reference to check points. All depths were taken from the actual surface of the ground. In the central portion of the mound this introduces an error since it is known that that portion was originally higher. This difference might have been three feet; but to introduce a supposition as a correction seems aside from the point. True comparative vertical positions could be indicated by reducing depths to elevations, i.e., by subtracting the depth from the surface contour over the position. In the central portion this would be simple since the surface contour for all is 37 feet.

Horizontal position has been roughly indicated by the use of areas. The successive cuts made by the shovel were subdivided with reference to the hedge around the plateau and the axis of the mound. The resultant areas were numbered as shown on plate 35. Each burial and artifact was, where possible, assigned to the area in which it was found. Area 1 is abnormally large partly because much of the work was done here before we arrived on the scene and partly because this portion of the mound had been previously demolished to a considerable extent.

For the intensive work three trenches were dug near the center of the mound (pl. 35). The center line of trench 1 was 22 feet south of the center of the mound; of trench 2, 22 feet north; of trench 3, 13 feet west. Trenches 1 and 2 extended both 25 feet north and 25 feet south of the center of the mound and trench 3 connected them. These trenches were six feet wide. They were sunk with shovels only and the material was removed in one foot stages until the bottom of the mound mass was reached. This gave a depth of from 7 feet 6 inches to 9 feet (fig. 3). The adhesiveness of the material due to dampness and the presence of such a large proportion of shell fragments of

various sizes precluded sifting without the spending of more time and money than Uhle's experience and our knowledge from the steam shovel work seemed to justify. The workmen were intelligent and interested, the work was done slowly, and much of the material was handled and examined a second time on the surface. Hence it is felt that a very fair percentage of existing artifacts and all burials were discovered.³² All burials were disinterred with the utmost care by the author and Mr. Loud. All finds were located by measurement of their distance east or west and north or south of the center of the mound.

Depths were taken by actual measurement from the then surface (15 feet elevation). Hence all trench depths have been corrected by the addition of 22 feet and may be directly compared with the depths of the steam-shovel work.

INTERNAL STRUCTURE OF THE MOUND

The lowest stratum beneath the mound of which we have knowledge is a layer of gravel. Where the well is, north of the mound, this is 17 feet thick. Above this is a stratum of yellow sandy clay which loses its sand and yellowness towards the top where it is blackish in color either from a previous vegetal growth or more likely because of stain from water which has seeped through the mound. This layer where tested by us averages about 3 feet in thickness. This thickness was obtained by sinking 9-inch holes with a post hole digger about 5 feet from one another in all three trenches.

Above the clay comes the mass of the mound proper.³³ Uhle divides this mound mass into ten strata which he depicts.³⁴ He apparently uses the term "stratum" with its usual geological connotations, and we understand that he meant a layer distinguished by definite character-

³² In note 31 the average number of cubic yards of material per burial was given. This was obtained by dividing the total cubic yards from the trenches by the total number of burials discovered. However this method is open to serious reservations. A burial on the average occupied a space 2 feet by 3 feet. When an indication of a burial was noted (perhaps a bare corner of the 2 by 3 space), it was exhumed and counted. In other words, if only burials lying squarely in the trenches had been counted the total number would be greatly reduced. It seems, therefore, that, as far as burials are concerned, allowing for the law of chance, an area wider than six feet was explored and that in figuring yardage per burial we would have to add one and a half feet to the trench dimensions, i.e., instead of having a trench 6 feet by 50 feet we would have in effect one 9 feet by 53 feet.

³³ Uhle's excavations indicated that at the one spot where he crossed the perimeter of the mound there had been a silting in of clay so that the clay stratum is not only under the mound but forms a wedge-like tongue extending into its slope near the base.

³⁴ *Op. cit.* pl. 4.

istics which extended over the entire area under consideration. Taken in this sense our study did not indicate that the mound contained any strata at all.³⁵ While Uhle's vertical vision was complete his horizontal horizon was very limited and we believe that had he run a second trench in a different portion of the mound he would have distinguished a second series of "strata" which would not have coincided with his first series either in character or number. This is due to the fact that the construction of the mound is lenticular. The lenses vary greatly in size, ranging from pockets a few feet long and a few inches thick to layers thirty or forty feet long and several feet thick. They do not lie in the same plane and some of the larger layers lie contrary to the general contours of the mound. Certain of these lenses of homogeneous material may dominate a considerable portion of a wall but entirely disappear a few feet to either side and pinch out in front or behind. Hence a drawing of any given cross-section would in our opinion differ from any other cross-section. However, within limited areas certain lenses were very dominant and one of the most notable of these was the calcined layer which extended over most of the northwest slope of the mound to a depth of 6 or 8 feet (pl. 36a). This is in the area explored by Uhle and helps to explain his strata. Another notable lens was in Areas 21, 22, 29, 30 (pl. 37a). Still another layer running parallel with the surface of the plateau and about 3 feet below it extended along the eastern part of the southerly wall of Area 8 and of Area 9 and the western part of Area 10. This was from 2 feet 6 inches to 5 feet thick and of a lighter color (pl. 36b). Heavy wavy layers of clamshell marked the southerly wall of Areas 19 and 20 (pl. 37b). Again, in Area 19 was a heavy curved lens of clamshells with the concave side up so that it formed a pocket perhaps 25 feet across. This pocket seemed to contain an unusual proportion of soil. This is in no way intended as a recital of the main structural features. They are simply examples cited to show the kind of features that existed. It is quite possible that could we have noted all the main features a study of their relationship might lead to something. We are unable to set down such features, however, and must rest with the negative conclusion that strata were not present.

The presence of moisture in the mass gave a false appearance of stratification. Supposed planes of bedding detected by trained observers disappeared with the drying out of the wall. If two or three cubic yards of material were

³⁵ At Ellis landing Nelson, also with full views in cross-sections, found an absence of strata. (N. C. Nelson, *The Ellis landing shellmound*, present series, VII, 374, 1910.) But when he dug a hole six feet square in the Emeryville mound he found "strata." (Manuscript notes.)

allowed to pour through the dipper from a height of several feet and a clean cut made in the pile the wall thus obtained presented an appearance of stratification analogous to that obtained from a cut into the undisturbed mass of the mound.

Both Uhle and Nelson proceed on the assumption that a lower level is older than a higher level no matter what its horizontal position. With lenticular construction only an area more or less directly under another area can be considered relatively older. For example, the top layers of Area 21 might well be older than the lower levels of Area 13.

This lack of strata extending over the entire mound and the presence of local lenses and pockets is what we should expect, since they would seem to be the more natural results of human life. Human activity should not be expected to produce a series of essentially homogeneous strata extending over the entire mound. Some of these pockets undoubtedly indicate fireplaces. Others seem to run contrary to the general contour of the mound as would be expected from depressions caused by house-pits. Still other pockets may have represented seasonal activities. A detailed and intensive study, which we were denied, might have made it possible to classify the pockets under such headings. The impression left on us was the strong conviction that if they were used as cultural indices it was just as necessary to consider them with reference to different horizontal areas as to different vertical "strata."

CONSTITUENTS OF THE MOUND

METHODS OF DETERMINATION

The main constituents of the mound are readily ascertained by field observation. To secure an accurate idea of their relative abundance would require a long series of physical and chemical analyses. Such have never been made and could not be made by us on account of the prohibitive financial cost. E. W. Gifford in his study of the composition of this and other California shellmounds³⁶ made some exhaustive analyses of the samples submitted to him and the interested reader is referred to that work for very comprehensive details. The present author must state, however, that several weeks' observation of the internal structure of the mound has impressed him with the need for great caution in drawing conclusions from such analyses.

³⁶ *Composition of California Shellmounds*, present series, XII, no. 1, 1916.

Where large masses of homogeneous material are dealt with, typical sampling is easy. In the peculiarly constructed shellmounds one taking samples is confronted with the practical necessity of making a choice. For example, Gifford states that in the samples he worked with "pockets and their contents have been purposely avoided as not being typical." Yet the mound at Emeryville is essentially a mass of pockets, now of ash, sometimes of clam, or again of mussel, etc. There are certainly hundreds of square feet of cross-section where the pocket is more truly representative of the content than is the balance of the area. Many of Gifford's Emeryville samples were selected by Nelson as being "characteristic of the stratum." Further selection is obviously necessary when dealing with such samples as Gifford had to work with. A sample almost all ash he includes; one almost entirely stone he rejects. His average sample was about 4 ounces, hence the sample taker had to pass over a stone or a bone as exceptional, or have a sample all bone or stone. In short the samples, first in the field and again in the laboratory, were selected local material. Error is therefore likely when in analysis or in the laboratory such samples become the type for wide areas and the basis for broad conclusions. To illustrate: Gifford's analyses are of necessity semi-physical, semi-chemical. Considering bone content, for example, the percentage he gets is what can be picked out by hand *after* the larger pieces have been left out in the field and not counting the smaller pieces that cannot be hand-separated. How can two mounds be accurately compared on the basis of such bone content? His percentage of ash is based on the chemical analysis of 5 grams. Samples taken at set distances will still be selective and misleading unless they are of considerable volume. The 20-foot mark may come in the center of a 3-inch lens of clam and a small sample will show a very high clam percentage. A shift of the point 6 inches in any direction would as likely as not show a large preponderance of mussel. Such small samples in large numbers might average up for the mound as a whole but would remain deceptive in comparisons of its different depths or horizontal areas. As intimated our next criticism is of the size of the samples. Nineteen samples (totaling some 6 pounds) are utterly inadequate for a miscellaneous mass of more than 26,500 cubic yards. If samples of, say, one cubic yard each, were taken on a fixed linear basis and all material therein carefully analyzed, first by physical selection and then by chemical means, a reasonably accurate estimation of main elements would be had. This would be tremendously expensive. Unless this is done, proportions of contents expressed in figures

are too largely a statement of percentages of selection and chance; and a probable source of error is avoided by sticking to what at other times is undesirable—the use of general descriptive phrases to express relative quantity. Hence in this connection our statements are of a general nature. In suitable places Gifford's percentages for certain of the constituents of the Emeryville mound are inserted for convenience.

Through the kindness of Mr. Ernest C. Bolté, Inspector of the Division of Chemistry of the California State Department of Agriculture, that department made three chemical analyses for us. The material for test 373 came from several points along the talus slope of the southerly wall of Areas 8, 9, and 10 and represented various horizontal areas as well as depths down to about 18 feet. Material for test 372 was taken at a depth of 25 feet in Area 9. Test 371 was of calcined material from the large deposit in Area 7. All samples were small in quantity. They were taken by thrusting a tubular tester into the mound, thus excluding all large pieces. The results obtained follow. Dashes in tests 372 and 371 indicate that the analyses were not carried out.

TABLE 1
CHEMICAL ANALYSIS OF SHELLMOUND MATERIAL

Test No.	371	372	373
Moisture, per cent.....	1.00	13.70	8.04
Calcium carbonate (CaCO_3), per cent.....	82.77	61.67	56.33
Calcium phosphate ($\text{Ca}_3\text{P}_2\text{O}_8$), per cent.....	3.07*	5.27*	7.43*
Magnesium carbonate (MgCO_3), per cent.....	1.55	2.27	1.49
Silica (SiO_2), per cent.....			18.45
Oxides of iron and alumina (Fe_2O_3 , Al_2O_3), per cent.....			.75
Water of constitution and organic matter, per cent.....			5.50
*Phosphoric acid, per cent.....	1.41	2.43	3.41

In addition to the above test Mr. Bolté carried out three secondary tests for the purpose of obtaining a comparative idea of the amount of phosphoric acid (a characteristic index) in animal and in human bones. All bones were from the mound and air dried. Test 374 was of animal bones; 375, of small human bones; 376, of large human bones. All were collected in approximately the same place—Area 8. The results show:

Test No.	374	375	376
Phosphoric acid, per cent in bones.....	32.8	32.3	33.5

In other words, the tests in the first series while indicating the presence or absence of bone would not enable us to state whether it was animal or human.

SHELL

The mound was composed principally of shell. Gifford's figures are 59.86 per cent and the Department of Agriculture tests indicate well over half. The shells were mostly those of clams (*Macoma edulis* and *M. nasuta*), mussels (*Mytilus edulis* and *M. californianus*), and oysters (*Ostrea lurida*). Cockleshells (*Cardium corbis*) were plentiful enough to be readily noticeable. Other shells found in much smaller quantities included: *Purpura crispata* and *P. canaliculata*, *Cerithidea californica*, *Helix*, *Standella*.³⁷ Still other shells were found in rare quantities and had apparently been treated by the former inhabitants in the manner of possessions. These are discussed under material culture.

The most casual observation indicated that clams or mussels or oysters predominated in given areas with reference to either horizontal or vertical divisions. Our data, however, do not permit us to determine the relative abundance of these species in the mound as a whole.

The clamshells are the strongest and were the least broken up. Indeed a very considerable percentage of entire valves appeared. Consequently these shells were very conspicuous, appearing in layers or lenses which were rendered more noticeable by their whitish color. Plate 38*b* shows portions of typical lenses. Such deposits were seen throughout the mound down to a depth of 22 feet. Below in the trenches we did not detect any notable layer of this kind. Clamshell was present but it was not conspicuous in specialized deposits.

Oyster shell layers were the next most conspicuous. Here again were many valves entire and perfect. These also were throughout the mound both above and below clam layers. There was a very definite deposit several inches thick at the very bottom of the western end of trench 2. This deposit was so free from débris attributal to human agency that it suggested a natural bed of oysters the existence of which might have been a contributing factor to original settlement near the site. It may be added that these shells showed no more disintegration than layers higher in the mound. These deposits of clam and oyster shell where other shell was practically absent and there was only a very small percentage of soil, though bones and artifacts were found therein, seem to imply periods during which a given species was almost exclusively gathered for food. Seasonal conditions or activities

³⁷ All these species have been reported by previous workers. Nelson reports for San Francisco bay shellmounds the following additional species: *Modiola* sp., *Myra arenaria*, *Tapes staminea*, *Tapes tenerrima*, *Acinea patuna* (op. cit., 338).

might account for such a specialization in diet. The apparent frequency of alternation makes such a theory more plausible to the author than one hypotheating an exhaustion and later replenishing of one or the other species.³⁸

Mussel shells are also very abundant, but being fragile they were seldom found entire. Hence they seldom form such conspicuous deposits though they constitute a very considerable part of the mound.

SOIL

Soil is the second largest constituent of the mound. This is noticeable in three forms.

In places layers several inches thick of pure clay such as forms the substratum were found. There was nothing about such layers to suggest house floors, fireplaces, or the like. Had they been of larger extent one might be tempted to adduce water deposition. As it is, no explanation of their presence can be advanced. Sand also existed in localized pockets though in much smaller quantities.

The bulk of the material distinguished as soil was the fine, black "filling" of the mound not specifically identified. It has been stated that the clam and oyster layers were comparatively free of soil and in other layers such as ash and calcined shell soil was a minor component. Otherwise it filled in the interstices between the other components and at places formed definite layers. Near the surface the slopes showed the most soil as was to be expected since the plateau was not the original top of the mound. Considering the four directions, the east slope seemed to show the greatest proportion. It is presumed that soil was present through vegetal decay, through having been brought in with shellfish, through the agency of the wind, and possibly from decayed acorn and buckeye shells, etc.

ROCK OR STONE

This material was present to a considerable extent. (Gifford's figure is 8 per cent.) Possibly the greater part consisted of a fine gravel such as is found in Temescal creek-bed or in the gravel stratum beneath the clay substratum. In many cases such gravel is covered with barnacles or sea growths which would indicate that it had been

³⁸ Uhle concluded that oysters predominated below and clams above. We have spoken of the oyster shell deposit we encountered toward the west just above the clay substratum. Also, we noted a large lens of clamshell near the top of the area where he worked. It seems, however, that his deduction is too broad for the mound as a whole.

brought in from the tidal flats with shellfish. A quantity of this gravel was collected from twenty-nine feet to thirty feet deep in trench 3. See sample A, table 2. Other rocks occurred in bits generally smaller than one's fist and these more often than not showed signs of having been used as fire-stones. A number of such fragments from the upper portions of the trenches compose sample B, table 2. For the comparison of these samples indicated in table 2 we are indebted to Dr. George D. Louderback.

TABLE 2
TYPES OF ROCK IN EMERYVILLE SHELLMOUND

Rock types	Number of pebbles	
	Sample A	Sample B
Franciscan sandstones (distinctive facies).....	8	8
Chert.....	17	25
Metamorphic rocks:		
Quartzite.....	7	4
Mica schist.....	1	2
Hornblende schist.....	0	8
Glaucophane schist.....	0	1
Meta-sandstone.....	1	0
Meta-shale.....	1	0
Greenstone (meta-diabase and basalt).....	5	2
Black hornblendite.....	0	4
Vein quartz.....	11	1
Leona rhyolite.....	7	0
Tertiary basalt, or basaltic andesite.....	16	51
More definite andesite type.....	3	1
Sandstone, brown, Cretaceous or Tertiary.....	11	11
Red micaceous sandstone.....	2	7
Monterey chert.....	55	4
Fresh water chert.....	0	3
Burned sandstone.....	?	13
Obsidian (small chip).....	0	1
Quartz porphyry.....	1	1
Gabbro.....	1	0
Monterey limestone.....	2	0
Amygdule.....	1	0
Red chert chips.....	0	2
	150	149

Sample A refers to bag sample marked "Shellmound débris, 7-8 feet deep, Trench 3." Sample B refers to heap of pebbles separated from mound débris and examined in field. Determinations made by aid of lens only.

Louderback points out that Sample A pebbles represent all the types of rock that occur in the Berkeley hills in the area drained by Temescal and Claremont creeks and that are likely to be recognized in creek pebbles. He sees no evidence of selection or sorting other than would be done by the creeks. Sample B pebbles are about the same

TABLE 3
DISTRIBUTION OF ROCK IN LOWER PORTIONS OF MOUND

Depth in feet	Trench 1		Trench 2		Trench 3	
	Burned	Quantity in pounds Unburned	Chert	Burned	Quantity in pounds Unburned	Chert
23 to 24.....				62	19	2
24 to 25.....				22	8.75	.25
25 to 26.....				40	6.5	3.5
26 to 27.....				13	7	2.5
27 to 28.....				26	9	6.5
28 to 29.....				27	7	4
29 to 30.....	45	10.5	.5	23	4	5
30 to 30.5.....					13.5	8.5
30 to 31.....	18	7	3	13	1.75	.25
31.....	15	3.5	1.5			

although they differ somewhat in relative proportion. This may in part be due to a different method of selection from the mound material. Sample A was carefully picked out after the material reached the surface. Sample B was made up of larger bits of rock which the shovelers found in the course of their work.³⁹

In the trench-digging an attempt was made to save out the coarser rock of which sample B is typical and while the results do not permit total content determinations they may be used in relative comparisons. The data are given in table 3. No collections were made from the upper levels of trenches 1 and 2. Chert is listed separately and was all apparently unburned.

The collecting was uneven and the determination of the burned rock could not be exact. Withal it would seem that the results might be fairly interpreted as showing that a very large percentage of the larger stones was brought in by man and used in connection with his fires or cooking. There is no correlation between depth and amount. Chert has been kept separate owing to the greater probability of its selection by man and to Uhle's belief that it occurred in greater quantities in the lower portion of the mound. The data do not seem to confirm this belief. That such stone was at times selected is undoubted. A cache, for example, was uncovered in trench 3, 29.5 feet deep, and a number of pieces had been used as hammerstones. The chert was generally of a coarse greenish or reddish variety. It is further discussed under "Material Culture—Eoliths."

VERTEBRATE REMAINS

Besides human burials, skeletal remains of many quadrupeds, birds, sea mammals, and fish were found in the mound. Gifford's percentages are: fish remains 0.186 per cent, other vertebrate remains 0.031 per cent. In other words, fish remains are six times as heavy as those of other animals. This implies a contingent train of possibilities which would characterize the inhabitants. Two of the small samples, however, were very much out of line with the others. Omitting these, the average for fish becomes 0.038 per cent, or about the same as for other vertebrate remains. This tremendous change indicates the danger in dealing with this material with limited statistics.

Aside from the question of their total proportion of the mound, it may be said that such remains appear in sufficient quantities to readily strike the eye in practically any part of the mound.

³⁹ Letter from George D. Louderback dated September 28, 1925.

Most of these bones were in comparatively small pieces, since practically all large bones had been broken or split, presumably for their marrow. Many bits of charred or burned bone were found in various parts. In the calcined layers all bone present had been burned and frequently had turned a greenish color. This color is so characteristic of the bones in these layers that it must be the result of a natural process, possibly the effect of sea water in contact with the bones as they were being burned. No bones were noted which gave evidence of having been gnawed, as might be expected were there dogs about camp. Nelson adds in this connection that dogs would not have been likely to leave so many practically entire bird bones.⁴⁰ Bones of wild animals were generally much better preserved than human bones from the same location.

While bones were scattered throughout the mound there was concentration in some spots. In some cases such spots were near evidences of hearths. This is particularly true of fish bones and fish scales. The latter were seen at times in compact masses (1-26031) several inches thick and covering perhaps a couple of square feet. It might be expected that the killing of even one large animal would result in a concentration of its bones at a given spot. It is noteworthy, however, that, while the bones of a given species do seem to characterize a concentration, the species may be a small animal. Spots were noted where gopher bones were present in relatively large quantities and the same was true of bird bones.

A great number of these bone remains were collected and turned over to the Museum of Vertebrate Zoology of the University where Miss Edna Fisher is classifying them and preparing a paper on the evidence which they present. Accordingly, we present herein only the provisional identifications and a brief statement of the points they suggest.

The species represented were about the same as those reported by Uhle with a few exceptions. They may be listed as follows according to Miss Fisher's preliminary determination.

Sea-otter, *Enhydra lutris*.—These bones were the most abundant in the mound with the possible exception of deer bones. They occurred at all depths down to the bottom and in various parts. Obviously this animal was of prime importance in the economy of the inhabitants. As it yields one of the finest furs known it seems probable that the fur was used as well as the flesh. Early explorers on the Californian coast

⁴⁰ *Op. cit.*, 339.

report otter skins as an article of dress.⁴¹ This animal is very rare now on the Pacific coast but was plentiful off San Francisco in early Spanish times.⁴² Its remains are too common to be accounted for by trade and it must have been consistently and successfully hunted during a great part of the mound's history. Such hunting suggests a considerable cultural advance. The Indians at the mouth of the Columbia river approached the sea-otter by boat when it was lying asleep on the rocks and used a crescent-shaped paddle blade because it helped render the approach noiseless.⁴³ The Eskimos hunted the sea-otter with boats and harpoons which were specialized for the purpose.⁴⁴ When the first Spaniards arrived in San Francisco bay they found the natives using tule balsas, or cigar-shaped rafts, with great dexterity. It is possible that such balsas were used in hunting otter. No evidence of harpoons was discovered by us.

Deer, *Cervus*.—Deer remains were more numerous than those of any other animal except the sea-otter. Their distribution was practically universal including the lowest levels. As a source of food the deer apparently shared honors with the sea-otter, and was used concurrently with that animal. There may have been seasonal differences which cannot now be detected, but the aborigines all during the mound's life seem to have been able to procure land and sea-food with equal facility.

Elk, *Cervus canadensis*.—Bones of this animal constitute the third most numerous class. Tule elk were exceedingly numerous in the San Joaquin valley and in the northern part of the bay district until recent times and it is likely that in early historic times they were abundant around the marshy shores of San Francisco bay.

There is a big difference between the quantity of bones of the above three species and that of any other. No doubt this is due in part to the more perishable nature of the bones of smaller quadrupeds, birds, and fish. Hence caution is required in basing conclusions on relative frequency. The species are listed in the order of the abundance of their remains as observed by us.

Fish.—Several species of fish were noted, none of which have been identified except the sting ray. This fish must have been a principal

⁴¹ La Perouse and Fages as quoted by H. H. Bancroft, *Native races of the Pacific states*, I, 369, 1886.

⁴² Bancroft says 8000 otter were killed in San Francisco bay in 1809-11. *Ibid.*, 383.

⁴³ Gabriel Franchère, *Narrative of a voyage to the N. W. coast of America in the years 1811-14*, 247, 1854.

⁴⁴ O. T. Mason, *Rep. U. S. Nat. Museum*, 1900, pls. 12, 16, 17.

food supply as its remains are very common. The bones indicate that many small fish were taken, which suggests fishing by means of a net. However, only one recognized net sinker was found—whereas in West Berkeley and Stege these articles were plentiful. Enough probable fishhooks were recovered to indicate that fishing by that method was employed.⁴⁵

Water-fowl.—Apparently a great variety of water-fowl were used as food including ducks, geese, cormorants, pelicans, waders, etc. The complete list, we are told, will include a great many species. This is very natural for the location must have been an ideal haunt for such fowl. During our work thousands of ducks were observed close inshore just off the mound. No evidence as to how they were caught was procured. But their remains in the mound imply, as Nelson states,⁴⁶ that the aborigines must have lived on the mound at least during the season the birds frequented the bay, i.e., the winter. Bones of these birds were in two cases found associated with burials in unusual quantities. One case was in the northwest perimeter, the other (12-3796) was in trench 2, twenty-five feet deep. Near the vertebrae of this body was about a pint of wing bones. In the first instance no particular bone seemed to predominate.

Whale.—Whalebone was found in the trenches and at a number of places in the cone. A single one of these animals would account for a much larger deposit than any seen by us. Still it would seem that every now and again the inhabitants utilized one of these mammals. Fages reported “whales” (possibly black fish) in San Francisco bay in 1772.

Seal (*Phoca*), sea-lion (*Zalophus*), and porpoise (*Phocaena communis*) were reasonably frequent.

The following small animals were possibly plentiful though their remains were fragmentary and tended to escape attention—rabbit (*Lepus*), gopher (*Thomomys*), raccoon (*Procyon lotor*), badger (*Taxidea*), skunk (*Mephitis occidentalis*), wild cat (*Lynx*).

Uhle and Nelson also identify the ground-squirrel (*Spermophilus*), the bear (*Ursus*), and the wolf (*Canis*). Up to the time of this writing our material had disclosed none of these. It seems likely that the squirrel will be forthcoming. Uhle's bear was based on one tooth which might have been obtained through trade, particularly since it had been worked into a pendant. At any rate bear remains are exceed-

⁴⁵ Nelson thought that fishing was an art unknown to the early Emeryville residents. (Manuscript notes.) Our evidence does not support this supposition.

⁴⁶ *Op. cit.*, 339.

ingly rare and since, according to Fages, bear were present in the vicinity, their absence in the mound is significant. While no wolf bones are present the genus is represented in our collection by the coyote.

Both Uhle and Nelson doubtfully identify the common dog. We can only join in their doubt. Skeletal remains were recovered which might have belonged to the dog or coyote. The evidence is so unconvincing that the author feels that doubts would be much stronger were the dog not *a priori* expected in connection with man.

Certain new species have been provisionally identified, notably the mountain lion (*Felis oregonensis californica*), the antelope (*Antilocapra*), the southern bald eagle (*Haliaeetus leucocephalus leucocephalus*), and the condor. To find the mountain lion where the bear is absent is unexpected. The antelope might be anticipated. The southern bald eagle has been noted in the San Joaquin valley and was formerly common on the islands of the Santa Barbara channel. This suggests the possibility that the bones present may have been imported. One of the bones identified had been cut off, apparently in the process of forming a tube of the missing portion.

ASHES

Ash⁴⁷ was found in many places in small crescentic pockets. It was light gray in color, fine, and densely packed, and what would be expected from a series of wood fires. These pockets are supposed to have been fireplaces, and are remarkably free from all substances save ash.

In addition to the pockets, ash was noted in layers. At 26 feet, 6 inches in trench 1, under burial 12-3778, was a layer of ash a couple of inches thick. Under the head of 12-3782 at 27 feet, 1 inch in the same trench, was a layer two and one-half inches thick. At about 25 feet, 6 inches in trench 2 was a layer extending over the entire western ten feet of the trench and a part of trench 3. This layer varied in thickness. Skeletons 12-3799, 12-3800 rested on it and a few inches above was a reddish line of paint, sand, and ash. Also in trench 2, near the eastern end covering an area wider than the trench and six feet or more long, at 29 feet, 1 inch, was a layer of reddish ash. Such layers suggest house floors, though our data are insufficient to push the suggestion further.

⁴⁷ Gifford's percentage of ash was 13.47.

In the northeastern areas of the cone, particularly on the slopes, were heavy layers of ash which were yellowish in color (pl. 37*b*). As has been indicated these layers were a foot and over in thickness and thirty or forty feet long. The ash mass seemed to be divided by the interposition of mound material so that three or four layers were indicated. In total mass these layers would be measured in cubic yards and to account for them is very difficult. The possibility of their being due to cremation is discussed on page 183. Seasonal ceremonials with intervening periods is the only other speculation we can advance.

The ash deposits cited above are only typical examples. Their relation to one another and to other features besides the burials in the trenches cannot be stated. The fact that such layers were so frequently just below the burials suggests that the bodies were covered over and not placed in a dug pit.

CALCINED MATERIAL

Isolated instances of calcined artifacts or material were noted in various parts of the mound. But in the western areas was a great layer of calcined material that was unique (pl. 37*a*). This did not extend over the entire mound as a stratum, and in character it offered such a contrast to the ash layers on the east that it would seem impossible to connect the two even if a mass of mound material did not separate them. This calcined layer is mostly shell but the shell has been thoroughly calcined. In the shell are bone fragments which are also calcined and frequently have a greenish tinge. This probably is the basis for Uhle's stratum of cremation. However, the analysis made by the State Department of Agriculture (page 172) indicates that there is less bone content in this calcined layer than elsewhere, and the chemists inform us that cremation would not destroy the value of the phosphoric acid index. In other words, even though a body had been cremated its presence would be indicated by this test. Hence if this was indeed an area of cremation we should expect a greater phosphoric acid content, whereas we have less. One test is far from conclusive but it is suggestive. We found no direct evidence of cremation in this layer and even if cremation occurred it is hard to understand why so many calcined shells should be present. One would rather expect ash layers such as those on the eastern slopes. The presence of so many shells suggests that their burning was connected with the preparation of their contents for food.

HUMAN REMAINS

CREMATION

The evidence which the mound yields with reference to the practice of cremation is rather remarkable. With the exception of two infants the lowest bodies found by us were 28 feet 7 inches deep. Here was a mass of burned bones in a layer of heavy charcoal two inches thick and more. This mass formed a concave lens about seven feet in diameter. Portions of the skeletons had been burned entirely away while other bones nearer the circumference had not been touched. By these it was possible to distinguish with reasonable certainty seven bodies (12-3807-13), of which four were infants or children. About six inches under the mass was the thin layer of reddish ash previously described and possibly a house floor. Within a few inches of this was the clay substratum of the mound.

This seems unquestionable evidence of cremation. It is as near the bottom (or beginning) of that part of the mound as it is possible to get. Evidently then, in the early history of the mound, cremation was practiced by at least one group that visited the site.

On the other hand, in all the balance of the trench work where thirty-four bodies were disclosed, there was not the slightest evidence of cremation. Skeleton 12-3801 lay upon a very light layer of charcoal but no bones were burned with the exception of the right knee and shoulder bones which were scorched. The suggestion here seems to be that the body fell or was buried on the family hearth, because one inch below the face is a layer of fine whitish ash one and three-fourths inches thick. Similar layers were associated with other bodies. Sufficient fire to account for their accumulation would certainly have done more than scorch a few bones of a single skeleton if the purpose had been cremation. This case (12-3801) is unique in other respects as will be seen from table 6. The individual had been wounded at least four times and died a death of violence while defending himself, as the blade in the hand suggests. For such a one to have been thrown on his own fire with the framework of his house about him, would not seem unreasonable. Opposed to such a hypothesis was our observation that the body was flexed. It seemed to lie on its face with the knees under it at the chest. The posture might have been accidental, however.

In the cone 651 bodies were noted. There was one possible case of cremation. In Area 32 at the 12-foot depth were found some bits of well-charred human bones (12-3745). In a few other cases, e.g., 12-3598, 3715, 3721, the skull appeared slightly calcined. Even if this discoloration be not due to age it might very reasonably be attributed to accidental scorching after burial considering that burials were apparently shallow and of necessity near subsequent fires, or to incidental burning through the use of fire in burial rites.

Uhle was convinced that "during the period represented by strata VI to VIII the dead were buried in the ground" but that during the period of the accumulation of strata II, III, and IV they were cremated.⁴⁸ Bearing this in mind, and leaving aside our inability to identify his strata, we searched diligently for evidence of such cremation, but with no results. Uhle's own evidence is indirect. First is the great mass of calcined material which we have described and which was probably his stratum II. It would also appear that cremation would result in heavy ash layers rather than in layers of calcined shell. This layer is primarily shell, and "shellfish thrown into the fire as food for the departed" seems an inadequate reason for such an accumulation. Another reason which Uhle cites for believing in cremation is the large percentage of calcined awls in stratum II. Here it seems to us that Uhle confuses awls with unworked bits of refuse bone which one might naturally expect to see burned. Our search did not result in many calcined bone artifacts nor in a concentration of them in a particular area. An amount of cremation sufficient to account for the mass of this particular calcined layer would imply the burning of many bodies. It seems impossible that all these should have left so few traces that in searching for them we should find none.

The case in Area 32 presents a few bones and considering the fires about the mound the writer would prefer to regard this as a case of accidental burning of bones sometime after burial. The evidence from the bottom of the mound is both direct and unmistakable. It may be questioned then, if the practice of cremation was known thus early in the mound's history why can it not reasonably be supposed that it was practiced thereafter? In the first place, no direct evidence supports the inference. In the second place, the hypothesis that in this early group that practiced cremation were the ancestors of the group that accumulated the upper levels finds no more support than the hypothesis that the cremation represents a visit by a group from across the bay where cremation was practiced.

⁴⁸ *Op. cit.*, 22.

BURIALS

From what has been said of cremation it will be seen that burial was at least the characteristic and ordinary way of disposing of the dead. The circumstances surrounding these burials offer the most suggestive evidence in the history of the mound.

Observation and Record

From October 21 (work began October 17) until December 1, when the mound was leveled, a record was kept of the burials seen. Always one and sometimes two observers made it a point to watch the digging for this purpose. Considering the general possibilities of observation, the efforts made to observe, and the results subsequently obtained in the trenches, it is believed that the record is a fairly accurate statement of the number of adult skeletons which were present in this cone of the mound at the time of its destruction. Of the upper eighteen feet of the mound particular certainty is felt, since here the chances to see everything were excellent. In the lower portions where a certain amount of talus material was always present it is probable that more burials existed than were counted.

One important reservation must be made. In the trenches, where the probabilities are that all skeletal remains were noted, thirty-four burials were distinguished. Of these, thirteen (38 per cent) were babies. The implied infant mortality while high would probably not be unreasonable for such a group. Uhle in ten burials found three infants (30 per cent). Now in the cone we saw very few infant remains and the probabilities are that we missed them on account of their small size.

Burials in the cone were recorded with reference to their horizontal position by placing them in one of the forty areas into which the mound was divided. When a skeleton was seen in position in the wall the depth was recorded. If it came down with a cave-in, or was first noted in a truck or elsewhere, it was recorded as of uncertain depth. These depths were eye estimates with check points to go by. In most cases the mere fact of the presence of a burial and its location was all the observer could note. Still there were many cases where it was possible to examine the burial with care and to complete the disinterment by hand. Hence evidence was secured concerning details. But since the majority of the burials were not thoroughly examined, the resultant data do not permit satisfactory comparisons between the cone and the trenches.

These data pertaining to horizontal and vertical distribution in the cone are presented in table 4. In this table the areas have been divided into three groups. Group I includes the slopes and perimeter, group II the outer part of the plateau section, group III the more central section.

In table 5 are presented all data obtained from the cone with relation to burial associations.

In the trench work exact locations were recorded which together with burial associations and all skeletal evidence from the trenches is summarized in table 6.

The work in the trenches, where we could be more thorough, is made the basis for the discussion of several phases that follow. At times the results seem to differ from those from the cone, and where these differences are not readily reconciled it must be emphasized that they may as well indicate the difference in our work as any cultural change.

Horizontal Distribution

The figures (table 4, last two columns at right) principally show that there is an increasing concentration of burials as the center of the cone is approached.

To the south between the cone and Temescal creek, two burials were found when digging out tree stumps. (One at 160 feet from the edge of the cone, the other at 75 feet; both about eighteen inches deep, and both twenty-five feet west of the plotted east limit of the cone.) Three burials were turned up by a plow in the northwest perimeter. Some ten feet north of Area 12 foundations for a tank were dug and several burials were disclosed. East of the cone in the continuation of the mound the railway cut brought to light a score or more of skeletons. All these burials were in shell. There appears to be a fringe of burials on the outskirts of the present cone.

In what is more definitely recognized as the cone, group I composes the periphery. This group is readily divisible into two divisions which are again subdivided into four directional regions.

	Region	Areas	Number of burials
Outer periphery.....	Southern.....	13, 14, 15	2
	Eastern.....	18, 25, 49, 39, 38	15
	Northern.....	37, 12, 1	16
	Western.....	2, 7	0
			33 or 5.07%
Inner periphery.....	Southern.....	16, 17	20
	Eastern.....	34, 36, 30, 22	15
	Northern.....	11, 6	44
	Western.....	0	0
			79 or 12.13%

The percentage is of the total burials in the cone. Thus the outer periphery contains less than half as many burials as the inner periphery. Nearly half of the burials in the outer periphery are in Area 12, in which direction the mound extended some distance. Practically all the others were toward the continuation of the mound to the east.

Group II, much smaller in extent, has 261 burials or 40.09 per cent of the total in the cone. Lastly group III has 278 burials or 42.71 per cent of the total. All this shows a constantly increasing intensification of burials as the central region of the cone is approached. In other words, there seems to be manifest a disinclination to bury near the outer edges of the mound. Is this connected with the existence of the great layers of calcined material which were most conspicuous on the slope of the mound on the west, south, and northeast? Possibly the calcined material postulates an activity which precluded burial in the same region.

From the directional regions indicated it will be seen that in each division of group I about 50 per cent of the burials were on the northern side of the mound. Group II may be similarly divided.

Region	Area	Number of burials
Southern.....	19, 23, 24	91
Eastern.....	31, 33, 35, 29	56
Northern.....	21, 10, 5	58
Western.....	3, 8	56
		261 or 40.09%

Here the greatest number of burials is on the southwest. Group III does not admit of directional division. This distribution may indicate that no particular side of the mound was constantly favored as a residential site, or that practices changed as to whether the non-residential territory was used as a graveyard, or whether bodies were buried near the living quarters.

The trenches cover such a limited area that distributional data from them are not very convincing. Trench 1 (south) produced thirteen bodies; trench 2 (north), twenty-three; trench 3 (west), five. Data for an east-west distribution are more suggestive. Omitting trench 3 which covers no eastern territory we find that trenches 1 and 2 yield twenty-three bodies from the western portion and only thirteen from the eastern. Of the thirteen, seven belonged to the cremated group. Infant burials appear to have been exceptional as will be seen later. Leaving them out, we have seventeen adult burials of which only one was east of the center of the mound. Our conclusion from this is that at a given time there was a tendency to concentrate burials and we discuss the matter further under "location of graves."

Museum No. 12-	Location	Depth	Orientation Skull Side	Artifacts	Position of artifacts	Remarks
3795	24' 6" N; 5' 9" W	23' 5"	SW	Face	In ash under head	Extended (?) 3" under head, layer of ash 3" thick.
3796	23' N; 18' E	25'	W	Many bird wings	Abdominal area	
*3797	21' N; 13' W	24' 3"				
†3798	20' N; 23' W	25'	}	Olivella—bead	Vicinity	Scattered. Charcoal and reddish ash below Charred elk antler near
—	17' N; 24' W	24' 10"				
—	17' 6" N; 25' W	24' 7"				
†3799	20' N; 15' 4" W	25' 3"	SW	L		Thin red line of paint, etc., strikes center of skull. Layers of white ash under body.
3800	19' 4" N; 14' 4" W	24' 9"	W	Obsidian point	Embedded in centrum 13th vertebrae; pierced from behind	Contiguous to and touching 3799. Layers of ash under body
3801	22' 6" N; 23' 6" W	25' 10"	W	Face	Left side, above tibia 1/4" in pelvic bone In 3rd lumbar vertebrae In R hand at base of skull Embedded in L cheek and upper jaw	1" below face layer of ash 1 3/4" thick Light layer of charcoal at right side. Knee and shoulder bones slightly scorched.
3802	24' 9" N; 15' 6" W			Flint point	1' W	
*3803	24' N; 4' W			Deer bone awl	1' W	
*3804	21' N; 11' W	27'	W	Bone pin	1' W	On layer of mussel shell
*3805	25' 3" N; 13' 6" W	26' 9"				In layer brownish paint
*3806	19' N; 19' W	26' 6"				In layer red paint and charcoal
3807-13	25' N; 4' E	26' 7"				Mass of burned bones in heavy layer of charcoal
*3814	18' 6" N; 11' W	28' 7"				Layer red paint near body
3815	13' S; 18' 5" W	22' 6"	W	Face	Shingled on garment (?)	Brown paint near body
3816	6' 6" S; 9' 9" W	23'		Olivella cir. beads Abalone pendants (3) Obsidian chip	Right scapula	Layer red paint below
3817	3' S; 16' 10" W	25' 5"	NW	Round bone artifact	4" N. prox. end R femur	Red paint on leg bones
3818	12' 3" N; 18' W	25'	SW	Mortar	Inverted over pelvis	Disturbed by visitors
				Mortar	Inverted over skull	Red paint on bones In layer reddish ash. No red paint on bones.

* Infant; † Juvenile.—Location and depth taken from center of skull, and is given with reference to center of mound. All flexed and in poor condition unless otherwise noted.

Vertical Distribution

Table 4 also gives the depths at which burials were found in each area of the cone.

The three groups seem to be relatively similar as regards vertical distribution, hence, for the only inferences which the author has been able to draw, it is simpler to use summarized totals.

Depth of burial	Number of burials	Per cent of total in cone
0 to 5 feet inclusive.....	17	2.61
6 to 10 feet inclusive.....	178	27.37
11 to 15 feet inclusive.....	236	36.26
16 to 20 feet inclusive.....	87	13.36
21 to 25 feet inclusive.....	31	4.75
Uncertain.....	102	15.65
	651	100.00

Even leaving all uncertain burials aside, considerably more than half of all the bodies (52.7 per cent) in the mound were located between six and fifteen feet, inclusive.

These figures should perhaps be adjusted somewhat. Round numbers should be more frequently used in estimates. Also the steam shovel did not consistently dig as low as twenty-five feet. At times it probably got no lower than twenty feet and it might be safer to leave out the twenty-one to twenty-five-foot level. Allowance also should be made for burials missed in the talus at about the seventeen to twenty-two-foot levels. The data still appear, however, to show a definite preponderance of burials around about the ten to fifteen-foot level and a marked scarcity in the upper levels. At Ellis landing Nelson found a very unequal vertical distribution and a scarcity of burials in the upper eight feet.⁴⁹

Turning to the trenches we find that of twenty-one adult burials sixteen were between twenty-five to twenty-seven feet. Since measurements were made to the skulls only, the fact that these sixteen burials belong to one level is plain.

With the exception of two infants the lowest bodies were at 28 feet 6 inches—the cremated ones. Otherwise as far as the trench data go a layer of mound material at least three feet thick appears to have accumulated before burials were made in that portion of the mound. If pits were dug for graves this accumulation must have been about five feet thick even with very shallow graves. This might be connected

⁴⁹ *Op. cit.*, 381.

with the hypothesis that the mound, growing by creeping out over marsh or tide-flat, was not usable until a height of three feet or so above the clay base had been attained. Above this the figures seem too confused for interpretation although there is possibly a hint at concentrations at given levels, e.g., twenty-five to twenty-seven feet in the trenches, then eighteen to twenty feet, then fifteen, then twelve feet, then ten feet. Finally, there seem to have been more bodies about the ten to fifteen-foot level than elsewhere; this possibility is discussed in connection with the problem of varying accumulation.

Graves

Location.—In our survey of the cone we were not able to establish a fixed relationship between the position of graves and such features as fireplaces, ash-layers, etc.

In the trenches the association with layers of whitish ash seemed too definite to be accounted for by chance. This was the type of ash which one would expect to accumulate on a hearth or fireplace. In the vicinity of the cremated group (seven bodies), of the group (eight bodies) in the west end of trench 1, and of five of the burials in the west end of trench 2, appeared the thin layer of red paint, sand, ash, and charcoal, which might have been a house floor. If these speculations are correct, burials seem to have been made in the house and very close to the hearth. There is at least one apparent objection to this hypothesis. The bodies were more or less contiguous as would be expected in a graveyard or regular burial place. Of course the house might have caused such a concentration yet it seems extraordinary that so many bodies could have been so intimately associated with an inhabited house. On the other hand, the nature of the group—adults and children—would suggest the home as the explanation for their association in burial.

Preparation.—It has usually been assumed that the dead were buried in graves which consisted of dug pits. From present-day views this is rational, but the evidence of the mound seems to point just as much the other way, that is, to the practice of placing the body on the surface of the ground and covering it over. Holes which had been dug for posts were indicated by the disturbed earth, and the purpose confirmed by the charred remains of the tops of the posts. But no such disturbed earth could be found above a single burial. On the contrary, burials were found a few inches below undisturbed pockets of clamshell which extended considerably beyond the bodies in all directions. Such

pockets could not have been dug through to place a body below them without leaving marked evidence of the fact, e.g., 12-3778, 12-3780. How could many corpses rest on the ash layers if placed in dug pits? A pit might be dug, ashes accumulated in it, and later a body placed therein. In such a case the ash deposit would not be flat but would indicate the pit, which was never noted. In the upper San Joaquin valley, Gifford and the author found that burials in low earth mounds were usually at the highest portion of the mound. Elmer J. Dawson has reported the same from the Sacramento-San Joaquin delta region. A reasonable explanation is that the portion of the mound containing the burials is slightly higher because of the covered-over burials made there. The many cases of non-pit burials on the Pacific coast of America, for example, in the Aleutian islands, the laid-out burials of the Cascades region of the Columbia river, the covered-over burials of the upper Columbia river, are too well known to require detailed citation as instances of the reasonableness of a recurrence of an analogous practice on the shores of San Francisco bay.

Nelson mentions disturbed burials in the Ellis Landing mound as evidence of dug burials.⁵⁰ Disturbed burials are so frequently reported in California as to be the rule rather than the exception (e.g., Heye—San Miguel; U. S. Geographical Survey—Santa Barbara; Gifford—Tulares; numerous private “diggers” with stories of massacres and the consequent dismemberment indicated by the disturbed skeletons). A great deal of this disturbance must be laid to burrowing animals. The settling of the earth must also be a factor. A large number of the skulls in the Emeryville mound were cracked and flattened in, presumably from the pressure of the material above them. However, a covered-over burial would spread and indicate more disturbance upon the settling of the surrounding material, than would a pit burial.

If bodies were generally buried by being covered over the attention would be given to the corpses rather than to the graves. At any rate what evidence there is suggests that scant attention was given to the preparation of the graves. Nelson reached the same general conclusion with reference to the Ellis landing mound.⁵¹ Uhle in his study of the Emeryville mound gives some rather elaborate details⁵² which were noted by the present author but given a much more limited significance than Uhle implies. For example, Uhle says a “layer of charcoal from one-half to an inch thick is found at the very bottom” of graves. An association of charcoal and burials was noted in the cone. In the

⁵⁰ *Op. cit.*, 383.

⁵¹ *Op. cit.*, 383.

⁵² *Op. cit.*, 24.

trenches it also appears. For example, charred pieces of what appeared to have been a large timber were under the head of 12-3784, under the feet of 12-3787, and in the general vicinity. Again a thin charcoal layer was under part of 12-3801. But it seems more reasonable to account for this charcoal in some other way than as a layer spread in a grave. It should also be remembered that similar layers could be observed, particularly in the mussel shell deposits, where there were no burials nearby. Above the layer of charcoal Uhle found "another layer of like thickness of iron oxide." In a number of cases we observed layers of iron oxide though not necessarily superimposed on a charcoal deposit. In other cases red or yellow "paint" in chunks was associated with a skeleton. In many others the bones had a reddish tinge. Our conclusion is that while red "paint" was frequently used in the preparation of a body for burial, and a supply sometimes buried with a person, there is no evidence that it was used in the preparation of graves.

Here and there, immediately under a skeleton, there seemed to exist an unusually large proportion of small stream gravel such as may be found in the neighboring Temescal creek. In possibly six cases evidences of decayed wood or mats that might have lined a grave or covered a body were seen.

Bodies

Position.—Practically all bodies had been flexed before burial, i.e., placed in the general position of knees to chest and heels to buttocks. A very few may have been extended. These few are so doubtful that it is probably safe to say that flexed burials were the universal rule throughout all levels and areas in the mound.

For the bodies in the cone no statistical data were obtained as to position of the body. Bodies were noted lying on the back and on either side and apparently with the heads in various directions. This agrees with what Nelson found at Ellis landing. In the trenches our evidence is more suggestive. Of the forty bodies disclosed the seven cremated bodies and the thirteen infant bodies are omitted. About an equal number of bodies (see table 6) were placed on each side, i.e.,

Right side, 6; left side, 7; face, 5; back, 1; (?) 1.

It is more than likely that settling and movements consequent upon decomposition make determination of the original position uncertain and that at least some of our "face" and "back" burials were origin-

ally on the side. Presumably the even favoring of the two sides is only chance, although if data were available it would be interesting to correlate it with sex.⁵³

These trench burials with reference to the direction of the skull may be summarized thus:

West, 11; northwest, 4; southwest, 2; northeast, 1; (?) 2.

In other words, over 94 per cent of the identifiable cases lay in a westerly direction. This seems too uniform a practice to be explained except by intention, and it is possible that the ordinary practice was to place the corpse with its head toward the sea, i.e., westerly. Heye found this true at San Miguel.

Preparation.—As far as evidence exists the preparation of the body for burial seems to have consisted of adorning it with red paint and with finery, although, this was not done for all. Many bodies in the cone, in the trenches more than half, showed no signs of red paint. In some cases the paint must have been spread on very profusely for the bones are heavily covered. At other times there is a mere trace. The variation may indicate a difference in social status.

The same remarks seem to apply to adornment. Body 12-3781 was entirely unaccompanied, whereas 12-3784 had abalone pendants on chest and head, and other ornaments. Body 12-3789 was adorned with necklace, bracelet, leg bands, etc. Other examples (see table 6) suggest garments or head coverings ornamented with shell. Such cases seem to indicate that the corpse was dressed as it might have been on ceremonial occasions in life. Presumably such ornaments were not especially prepared for burial purposes but were those ordinarily used for adornment in life. Hence their profusion or lack thereof would represent the relative wealth of the possessor. There is another inference from this preparation. In the upper levels the eyes and (or) face were frequently covered with abalone ornaments. And the finding of olivella beads inside the jaw, apparently in the ears, and abalone discs over the eyes, mouth, and in the crotch suggests the practice of covering the openings of the body with such shell ornaments.

⁵³ Uhle states (*op. cit.*, 24) that "the corpse is usually laid upon the right side, generally facing northeast." This would appear to orient the skull southwest. However, the details which Uhle gives for his six adult burials do not seem to bear out his general statement.

Burial Methods

Associations.—Closely connected with the preparation of the body must have been the association with the corpse in burial of various artifacts. The principal associations noted in the cone are listed in table 5, while table 6 gives the associations in the trenches. It must be emphasized that table 5 is by no means a list of all the burials in the cone that had associated artifacts, and, on the other hand, that a great many burials, perhaps the large majority, were utterly without associations. The implication is strong that different associations represent a difference in social status.

Three questions present themselves. What kind of objects were associated with burials? Does the complexity of association and the type of object change in the upper levels? The last question is dealt with under material culture. In considering the others it seems that olivella beads, abalone pieces, and paint should be omitted since they represent personal adornment as distinguished from other possessions.

In the trenches some of the cases listed in table 6 are doubtful associations, e.g., the flesher with 12-3778 was two feet away. Of the remaining cases, 12-3800-01 and probably 12-3791 do not represent burial associations but rather weapons which could not be removed. It should be noted that in all these cases ornaments were also missing. There are then four burials (12-3778-79, 3785, 3815) each with one bone artifact in association. In addition 12-3815 had a small obsidian unworked chip near it. The pestle in the ash under the head of 12-3795 is doubtful of association; the flint point more likely. Body 12-3784 had an inverted mortar in the chest region while 12-3817 had one mortar inverted over the head and another over the pelvic bones. Finally, 12-3796 was accompanied by many bird-wing bones.

As will be seen under material culture the number, variety, and quality of objects recovered from the trenches makes the above first five cases of association seem peculiar. Why bury such insignificant objects with the dead when more valuable ones were possessed? Moreover, in none of these cases was an ornament present. Considering these things in connection with the hypothesis that these bodies were buried in or near the house it seems reasonable to expect from the laws of chance some artifacts near bodies as well as elsewhere. These associations then would be accidental not intentional.

The association of the mortars with bodies is discussed later. In both cases the body showed other evidences of care in its burial.

The case of the bird bones appeared to be an undoubted case of burial association. Yet those are not artifacts nor do they appear valuable. Neither ornaments nor other artifacts were with this burial. In the northwest perimeter with 12-3769B were also found many bird bones. This last burial was at the fourteen-foot elevation and as 12-3796 was at the twelve-foot elevation it is possible that they are of the same era, though the latter was under the cone. Whether the bones were put into the grave as bones or as wings, whether they were raw material, or intended for food, or were proofs of skill as a hunter, cannot be stated. It does seem probable that they are related to the instances where a number of similar articles were associated with a body. For example:

8 whistles at 12 feet in Area 6; 5 open-sea clam shells at 12 feet in Area 19; 9 whistles at 15 feet in Area 10; 40 sting ray barbs at 15 feet in Area 10; 5 whistles, 3 pipes at 16 feet in Area 31; 2 plummet-like stones at 16 feet in Area 33; 2 plummet-like stones at 20 feet in Area 10; 6 bone tubes at ? feet in Area 20; 9 plummet-like stones at ? feet in Area (?).

A group of obsidian points was also secured by other diggers. These instances seem to indicate some form of specialization but whether of manufacture, use, or ownership seems indeterminable. The bone tubes suggest manufacture; the whistles, use; the pipes, ownership.

Turning to the cone, table 5, we find the lowest recorded burial associations (20 feet) comparatively elaborate. The one in Area 20 was particularly so. Paint was abundant. The wrappings had been heavy. Some wooden material had been present, a quartz crystal, a mica pendant, and an unusual piece of mineral or mineralized wood were found in addition to ornaments. At this depth were plummet-like stones. At seventeen feet we meet the first pipes; at sixteen feet the first whistles. (Whistles were found in the trenches, but not in burials.) Thus far it might appear that a case of increasing complexity of culture was being made out as we approached the upper levels. The doubtful nature of such a conclusion will be more apparent by considering the various articles of material culture. The question of increasing complexity of burial associations is even more doubtful. Especially do the upper ten to eleven feet of the mound appear to be as simple as the lower ten feet.

Olivella beads and abalone ornaments were associated with burials throughout, and very few were found that were not thus associated. Bone articles were more definitely associated in the middle levels. Throughout more bone articles were found not in association than in association. Obsidian found throughout seems more definitely a burial

association above sixteen feet. Other articles are of such sporadic occurrence that comparisons seem useless. On the whole, however, it might be said that burial association seems somewhat more elaborate in the middle portions of the mound. But any conclusions which might be drawn seem vitiated by the fact that equivalent or greater differences might be found by comparing horizontal areas. This is not done because what was found was dependent not only on what was present but also on whether or not the steam shovel gave us an opportunity to recover it.

A few special association traits may be noted. In the trenches were two instances and in the cone a considerable number where a mortar had been inverted over a portion of the body, or where a portion of the body had been placed in a mortar. These were usually type IV mortars. Such burials seem to have been particularly numerous in Areas 8 and 19. In other Areas, notably 5 and 10, were a great number of "killed" mortars of porous basalt. These were also associated with burials but never contained bones. As far as the evidence goes this is a case of horizontal rather than vertical distribution.

The "killing" or breaking of objects associated with burials was noted with other articles than mortars. The nine beautifully shaped plummet-like stones found with a burial had all been broken, though so many of the pieces were present that rather complete restoration could be made from the fragments recovered. Several of the whistle groups suggested deliberate breaking, but it is here difficult to be certain. No evidence of the "killing" of objects appeared in the lower levels, and no "killed" ornaments were found.

Infant burials.—Infants or young children seem to have been treated differently from adults. In the cone very few infants were found and most of these were closely associated with adults. Very likely the others were missed. In the trenches no infants were found associated with adults. In fact, it looks as though they had been deliberately buried in quite distinct locations. In trench 1 were three infants, all well to the east of other burials. Two of these were the deepest burials found (28 feet 10 inches and 31 feet). None showed ornamentation, but an awl was near one. In trench 2 were nine infants (the cremation group excepted). Three of these were well to the east of the adult group. These three were close to one another and all bore signs of comparatively elaborate preparation, much more than many adults. The other six were interspersed with the adults but none of them was accompanied by an artifact. No infants were in trench 3. Our conclusion is that infants were treated with less consideration

than adults both with reference to preparation for burial and to choice of burial place. Uhle's four infant burials were not grouped. Two were without an artifact; but the other two were his most elaborate burials.

The three infants in trench 2 placed close together and all elaborately prepared (12-3792-93-94) may be presumed to have belonged to the same household, one that was of more than usual importance. The artifacts with them could not have been self-acquired and were apparently definitely adapted to the infants in the form of garments. Such a case may simply represent unusual parental care but there seems also a hint of importance of family.

Group burials.—From seventeen feet to twenty-five feet west of center in trench 1 were seven bodies (12-3781-82-83-84-87-89-91 at about the same depth, touching one another in some cases, closely associated with the same object, e.g., charred timber, in others. It has been postulated from the ash layers and possible red floor lines that these burials are those of a single group made in or about the group's dwelling place. One of the bodies was elaborately adorned, another well adorned and associated with it a mortar, a third had an obsidian point, a fourth an olivella bead, and the other three nothing at all (see table 6). Such differences might represent those of a family. On the other hand, the even depths of the burials, the fact that one has not broken into another, the charred timber, and the variety of the burials suggest an identical or nearly contemporaneous interment.

The group in trench 2 was somewhat more scattered (12-3798 to 12-3802). They extended from 15 feet 4 inches to 23 feet 6 inches west of center. Here we had a juvenile skeleton very much disturbed and scattered, and an infant, both near a charred elk antler; another juvenile; a probable male of about forty with an obsidian point in his back; an adult male with a number of obsidian points embedded in him; an adult of forty-five with no artifacts. Ash layers were under these bodies and charcoal was evident. The absence of ornaments from all bodies but the presence of artifacts in the vicinity suggests a hasty burial. This may represent a contemporaneous burial by a group living on the mound in which event the inclusion of two men slain in fighting would not be remarkable. The most persistent reconstruction, however, is of a family group surprised and slain in its own house, one of the men at least making a desperate resistance and being wounded five or more times before being overcome, when he fell upon his own hearth and was partly burned. In such an event we must presume that before the bodies could be disturbed by animals friends returned, flexed at least some of the bodies, and covered them over.

This indication of violent death on a scale which suggests an outside group is interesting since it implies visits of groups from other places bringing with them different customs and objects of material culture.

The seven bodies in the cremated group (12-3807-13) suggest an intrusive custom on the one hand, and on the other, seasonal or group disposition of the dead as mentioned for the group in trench 1. These seven bodies burned at the same time would represent the deaths in a group of, say, 100 over a period of some months. Can this mean that groups visited the mound and disposed at one time all those who died during such a visit?

SKELETAL EVIDENCE

Preservation

The condition of the bones varied greatly. Some were firm and sound; others in such condition that they crumbled on being handled. Condition was apparently independent of location and age. Bones found near the bottom of the mound were at times in better shape than those from near the top. Similar differences existed with reference to horizontal distribution. Perhaps on the whole the bones from the trenches were in worse shape than those above. At any rate in the trenches every skull was cracked and many of them had been pressed quite flat. Bird and animal bones were much better preserved than human bones from the same location. In general, the poor condition of the bones makes it impossible to secure desired skeletal data.

Age and Sex

From the skeletal material collected from the cone Gifford and Loud have been able to make sixty-seven sex and age determinations using the skull and teeth as indicators. The results are given in table 7.

TABLE 7
AGE AND SEX OF DETERMINABLE SKELETAL REMAINS

Age	Male		Female		Total	
	Number	Per cent of males	Number	Per cent of females	Number	Per cent of all
40 years or less.....	3	6.4	2	10	5	7.4
45 years.....	4	8.5	7	35	11	16.4
50 years.....	13	27.7	6	30	19	28.4
55 years.....	11	23.4	2	10	13	19.4
60 years.....	16	34.0	3	15	19	28.4
	47	100	20	100	67	100.

No skulls were obtained from the trenches, but thirteen out of thirty-four burials were infants (38 per cent).

It would seem that we missed many infants in the cone. Yet even allowing for such oversight, the proportion of infants is unreasonably small. Moreover, in the trenches only two bodies were noted between the very young infants and the age when wisdom teeth are cut. This age is even more scantily represented in the cone. At Ellis landing Nelson noted the same disproportion and suggests, to account for the fact, a low death rate among adolescents or the possibility that only the old and infirm lived permanently on the mound.⁵⁴ Reverting to our table we find that 92 per cent were forty-five years old or older. There are serious objections to placing too much weight on the conclusion suggested by this large percentage. Six hundred and eighty-five burials were noted but only sixty-seven (9.8 per cent) are included in the table. An inclusion of all burials might—probably would—change the proportions since the skulls examined were those which were firm enough to withstand the rough treatment of the steam shovel. The skulls of young people would be more likely to have collapsed. In using the teeth as a criterion without a known standard one is more likely to place the age too high than too low. If Nelson is right we have an indication of non-continuous residence on the mound; but we feel that such a segregation was unlikely and that a full determination of ages would reveal a more nearly normal proportion of middle-age deaths. It will be noted later in this paper that we follow Nelson in assuming an average life to be 33 years. If this figure should be changed to accord with the present data our results based thereon would be rendered all the more reasonable.

Some 70 per cent of the determined bodies were males. The low percentage of females may be accounted for by the greater fragility of their bones as mentioned above. In fact, this disparity between the sexes leads one to doubt the data rather than to speculate on an explanation. A tendency toward earlier death is noted among the females. But on Nelson's hypothesis physical disability, not number of years, would be the basis for a division of the population on or off the mound, and we are left without a cause for the disparity in sexes.

Crania

Such cranial measurements as could be procured have been presented by E. W. Gifford.⁵⁵ Mr. Gifford informs me that the cranial type is the typical California type and that there is nothing about them

⁵⁴ *Op. cit.*, 382.

⁵⁵ Californian Anthropometry, present series, xxii, 370-373, 1926.

to indicate a change between the higher and lower portions of the mound. It seems possible that a prolonged study might indicate physical similarities with inhabitants of adjacent territories. The present author cannot conceive a "shellmound people" and physical affiliations might help to explain the seeming variations in material culture.

Pathological Data

Very few unusual or diseased bones were noted. Body 12-3801 had the left tibia and fibula pathologically united at the ankle, probably the result of a break. A body in the northwest perimeter had a pathological elbow. Number 12-3604 had an unusually large jaw apparently due to the teeth not having been properly cut. Number 12-3640 had indentations in the forehead suggestive of fractured bones' healing and leaving pits. A skull with a rare, diamond-shaped suture formation was also seen.

STATISTICAL SUGGESTIONS

Varying Rate of Accumulation

Whether or not specialists produce illuminating data from the examination of these human remains, their mere number and location is one of the most definite forms of evidence the shellmound yields. It has been assumed that the shellmounds are accumulations of human refuse and that the population responsible for the accumulating is buried therein. To be exact the current population would have to be added. The data on vertical distribution have shown that half of the population of the cone was concentrated in some six feet of the cone. How then could the other half of the population pile up the fifteen feet or so of the balance of the cone?

A similar varying rate of accumulation per burial is seen when different mounds are considered. Data secured by three investigators may be tabulated as follows:

TABLE 8
MATERIAL PER BURIAL IN VARIOUS MOUNDS

	Quantity of mound material	Total burials noted	Cubic feet per burial
Uhle, Emeryville.....	7,000	10	700
Nelson, Ellis landing, graded portion.....	67,500	140	482
Nelson, Ellis landing, trench.....	5,500	16	343
Nelson, Ellis landing, shaft.....	560	4	140
Schenck, Emeryville, cone.....	715,500	651	1,100
Schenck, Emeryville, trenches.....	7,038	41	174

For the closer work the figures require correction. It has been seen that entire areas in the cone yielded no burials but must have been accumulated by those buried nearer the center. Hence comparisons can be made only with data which include perimeter areas as well as central areas of the mound, in other words, Nelson's scraper work and our steam-shovel work. In both these cases infant burials are practically eliminated. It seems fair to conclude that the same errors of observation would have existed in both cases. With these reservations, a comparison shows that Ellis landing accumulated at the rate of 482 cubic feet per burial and Emeryville at the rate of 1100 cubic feet per burial. Three explanations suggest themselves for this varying rate of accumulation: cremation, change of food habits, and non-continuous residence.

Cremation

If some of those who accumulated, lived, and died on the mounds were cremated the present problem would break down. But neither Nelson nor the author found sufficient evidences of cremation to justify the conclusion that cremation existed to any appreciable extent.

Change of Food Habits

Shellmound constituents have been used by investigators as indices of the diet of shellmound residents. Because of the difficulty of accurately determining these constituents such evidence cannot be leaned upon too heavily, but its general indications seem strong enough to support the limited conclusions arrived at under this heading.

Suppose one group of shellmound dwellers were to subsist upon a diet of 90 per cent acorns and 10 per cent shellfish and an equal group on 30 per cent acorns and 70 per cent shellfish. Suppose, further, that the non-shellfish diet leaves little or no trace. It has been suggested that in such a case two similar mounds might result, but this does not seem possible. If shells are being cast aside in one place, say, seven times as fast as in another, heaps of different types must be formed. The layers or lenses of shell produced should differ since the same amount of natural and human wear and tear would each day impress itself upon vastly different masses. More important, the proportions of the constituents of the mounds would differ. In other words, the ash from daily fires, wind-blown dust, mud tracked in, and all other natural or human non-dietary accumulations would be roughly the same in both mounds each day although in one case they would be

associated with seven times as much shell as in the other. Finally, human skeletons are an essential feature of these mounds. If a man lived upon a 90 per cent acorn-10 per cent shellfish diet he would leave behind him when he died a smaller accumulation than if his diet had been 30 per cent acorns and 70 per cent shellfish. These considerations lead us to the following generalizations: The greater the proportion of shell the more rapidly was the mound accumulated, and the larger should be the mass of material accumulated for each body buried therein.

Turning to two cases for which data are in hand we note from Gifford's analyses that the average shell content at Ellis landing was 69.43 per cent, while at Emeryville it was 59.86 per cent. Since, then, shellfish made up a larger part of the diet at Ellis landing than at Emeryville, the former mound should show a greater volume of mound accumulation per capita, whereas the contrary is true. The mere existence of the mounds predicates that we are dealing with a diet largely of shellfish and the shell-content figures show that at Ellis landing a greater proportion of shellfish was eaten than at Emeryville. It would require then the assumption of an impossible reduction in the daily shellfish consumption at Emeryville in order to harmonize the per capita accumulation.

Non-continuous Residence

In the above discussion we have followed our predecessors who have assumed that a given mound was a place of continuous residence. If we drop this assumption it is easier to explain the varying rates of accumulation for, if a group lived on a mound only part of the year, it might live on that mound a longer time each year than some other group upon another mound, and varying ideas as to burial in the shell-mound site or the residential site for the balance of the year would make it unreasonable to assume that all those responsible for the accumulation of a mound were buried therein. This would explain not only why different mounds showed different rates of accumulation per burial but also the variations noted in the different levels of the same mound.

If residence on the mounds is established as non-continuous or seasonal, as seems probable, not only are we assisted in considering the habits of the aborigines, but we also have an important factor in determining the age of the mounds themselves. The skeletal evidence is as concrete as anything we have bearing on the subject and so the question is pursued farther.

Thus far no notice has been taken of three unknown factors which must be assumed, i.e., the current population of a given mound, the average human life, and the daily rate of accumulation of mound material.

Current Population

From house pits discernible, Nelson supposes the current population at Ellis landing was 100.⁵⁶ Gifford assumed that the same population inhabited Emeryville.⁵⁷ This figure seems as reasonable as any which it is possible to obtain.

Average Life

Nelson estimates the average life at 33 years.⁵⁸ Since we are leaving infants out of consideration and few children are found among the burials it is possible that this is too low. It is however essentially correct. If the figures given by us on page 203 are more nearly correct, the reasonableness of the views advanced below is enhanced.

Rate of Accumulation

Nelson decides that a person will accumulate 0.01 cubic feet of mound material per day,⁵⁹ in which Gifford acquiesces. The skeletal data and accepted assumptions may be applied to this figure.

If one person accumulates at the rate of 3.65 cubic feet per year and lives continuously on the mound to be 33 years old, then the 140 lives represented at Ellis landing would accumulate 16,863 cubic feet; and the 651 lives represented at Emeryville would accumulate 78,412 cubic feet. But at Ellis landing the portion of the mound actually containing the bodies amounted to 67,500 cubic feet, and at Emeryville to 715,000 cubic feet. This leaves some three-quarters of the Ellis landing mound and nine-tenths of the Emeryville mound to be accounted for.

From another angle, if a person accumulates 3.65 cubic feet per year, then the average life of the 140 accumulating the 67,500 cubic feet at Ellis landing would have to be 151 years; and of the 651 accumulating the 715,500 cubic feet at Emeryville it would have to be 309 years.

⁵⁶ *Op. cit.*, 346.

⁵⁸ *Op. cit.*, 381.

⁵⁷ *Op. cit.*, 13.

⁵⁹ *Op. cit.*, 346.

The rate of accumulation seems much too low. Further, it is obvious that an adjustment which would fit one case would not fit the other so long as continuous residence is assumed. With an adult population, an annual death rate of 3 per cent would appear to be a maximum. The Emeryville cone with 1100 cubic feet of material to each body is again a maximum. Now, with continuous residence and a 3 per cent death rate, the 651 Emeryville bodies would indicate an ultimate population of 21,700 persons. Since the bulk of the cone is 715,500 cubic feet, each man each year must have accumulated 32.9 cubic feet.

Or, if residence on the mound was continuous then the bodies in the mound plus the current population must account for its accumulation. The current population on account of its smallness and the probable term of years involved may be ignored without essential error. Then at Emeryville, since one body represents a mass of 1100 cubic feet and its average life is 33 years, the rate of accumulation would be 33.3 cubic feet; which checks closely enough with the estimate from different factors (32.9). The corresponding figures for Ellis landing are 14.4 and 14.6 cubic feet, about four times Nelson's estimate.

Is a rate of 33.3 cubic feet per year possible? Gifford established the specific gravity of shellmound material as 1.3, or 81 pounds per cubic foot.⁶⁰ His percentage of shell content varied from 69.43 per cent at Ellis landing to 59.86 per cent at Emeryville with 55.59 per cent as an average for San Francisco bay mounds. Again, to be on the maximum side, let us allow 65 per cent. Then each cubic foot of mound material contains 52.65 pounds of shell;⁶¹ and the 33.3 cubic feet accumulated per year means that one adult would accumulate 1753 pounds of shell per year or 4.8 pounds per diem. According to the present weight of the shells of similar oysters and clams this would mean a daily ration of 75 clams or 250 oysters. These oysters are tiny and a modern man would think nothing of consuming 30 or so of them a day as cocktails in addition to his regular meals. The clams also are small. To the author there seems nothing improbable in an aborigine's eating the requisite number. From the point of view of food values 75 of these clams or 250 of the oysters (uncooked) would have a food value of from 600-1000 calories⁶² whereas a reasonably active man requires from 3000 to 4000 calories daily.⁶² Nelson treats clams and oysters as equivalent, but this does not seem to be the case. No matter how

⁶⁰ *Op. cit.*, 12.

⁶¹ M. S. Rose, *Feeding the Family*, 343, 1918.

⁶² *Ibid.*, 54.

under-nourished the shellmound population may have been, 50 tiny oysters daily per man would not have been nearly enough to support life.

In judging how many shellfish might be eaten, it is well to consider how they were prepared. Abbott in writing of the shellmounds of the Atlantic coast says that oysters and mussels were prepared in large quantities for winter use, "probably being dried and ground in mortars."⁶³ Strong, an educated observer long resident on the lower Columbia river, states "the Indians near the Coast made trips to the ocean for clams. These later were dried and smoked and so cured."⁶⁴ Such citations seem to indicate a widespread custom of drying shellfish, and, when considered with well-known similar aboriginal practices with other food-stuffs, suggest the reasonable possibility that shellfish were so treated on San Francisco bay. When dried and pulverized the inadequacy of 50 tiny oysters as a daily ration becomes more striking.

Summarizing, our conclusion is that a daily ration may be assumed which will check with the burials seen in the mound material handled, and with the maximum rate of accumulation necessitated by them.

The point may be advanced that if residence on the mounds was non-continuous, a greater daily rate of accumulation would be required. This does not seem necessary, for if residence was non-continuous a population would be engaged in eating which would not be reflected entirely by the burials in the mound. Further, if shellfish gathering was of a seasonal nature, it may be presumed that during the visits to the mound this work was intensive and that the shells resulting from a visit represented not only consumption but food prepared and carried away to be eaten later.

Time of Accumulation

Having assumed a current population of 100 and a possible maximum accumulation at the rate of 33.3 cubic feet per year per person, a simple calculation determines that it would have taken but 215 years for the mass of the cone (715,500 cubic feet) to be accumulated.

But under this cone was an additional volume of perhaps 400,000 cubic feet, and there was shell to the north and on the perimeter, say 315,500 cubic feet. Thus the volume is doubled to 1,431,000 cubic feet, and, other conditions remaining unchanged, the time of accumulation would be increased to 430 years.

⁶³ C. C. Abbott, *Primitive Industry*, 149, 1881.

⁶⁴ Thomas Nelson Strong, *Cathlamet on the Columbia* (1906).

Now in the earlier part of this paper the opinion was expressed that this cone was simply part of a mound covering a much larger area and containing perhaps 150,000 cubic yards in its base. On this base were at least two cones, so that as a maximum highly speculative figure it might be said that the total shellmound mass at Emeryville was as much as 6,000,000 cubic feet. It would take about 1800 years for a population of 100 to accumulate this. However, since the size of such a site is more than double that considered as the cone and since at least two cones are present, a larger population, say at least 200, seems more than probable. In short, 1000 years would appear to be the greatest possible period allowable for the time of accumulation of all shellmound material on the Emeryville site.

From 245,000 cubic feet in sight, Nelson estimates the entire Ellis Landing mound at 1,260,000 cubic feet. Proportioning the 160 observed burials in the 72,000 cubic feet of material handled, he decided that there should be 3000 bodies in the mound. Then dividing this estimated mass (1,260,000) by the assumed current population (100) multiplied by the estimate rate of accumulation (3.65 per person for year) he determines the time of accumulation of the mound as 3500 years.⁶⁵ However, other of his factors may be applied. With a current population of 100, an annual death rate of 3 per cent, and 3000 bodies in the mound, it would have taken but 1000 years for these bodies and the mass enclosing them to be accumulated. Or, since each life represented accounts for 482 cubic feet, and the average life was 23 years, the annual rate of accumulation would have been 14.6 cubic feet per person. This increase of the rate by four would cut the time of accumulation down to 875 years.

Gifford estimated the time for accumulation at Emeryville as 3300 years. But he assumes the same current population and rate of accumulation as at Ellis landing. Then, since he uses Uhle's estimate of the mass of Emeryville (39,000 cubic meters), he is bound to arrive at a result nearly the same as Nelson's for Ellis landing where nearly the same mass was used (35,650 cubic meters). In other words, this estimate introduces no new evidence and is simply a mathematical corroboration of previous ones.

Gifford estimates the time of accumulation in another way. By analyzing nineteen samples he determines an arithmetical average of 13.47 per cent which he takes as the ash content of the Emeryville mound. Then, on the basis of Uhle's estimate of 39,000 cubic meters as the mass of the mound, he finds that 7528 tons of ash would be present in the mound. Averaging the percentage of ash present in trees likely to be accessible to the mound-dwellers, he decides that the ash would represent 0.9 per cent of the wood burned. It was assumed that the current population was about fifteen families of seven persons each, and it followed that each family would have to consume about 88 pounds of firewood daily if it took 3700 years for the mound to accumulate. He judges this daily consumption of 88 pounds to be reasonable and hence 3700 years is also taken as reasonable.

Several objections to this method appear. In the field the samples were selected, and in the laboratory those that showed no ash were not used. Five grams each of those used were tested chemically. It is very difficult to deter-

⁶⁵ *Op. cit.*, 381.

mine accurately the ash in a shellmound because of the identity of elements involved. Also, one sample of no ash included instead of being selectively eliminated would make a difference of 0.71 per cent in the result. The ash content once determined is not necessarily equivalent to the residue of wood fires. Hence the 13.47 per cent cannot be taken too exactly. (The samples ranged from 0 to 28.11 per cent; the tests from 3.37 per cent to 28.11 per cent.) Yet a change of 1 per cent in this figure, with other factors remaining unchanged, results in a change of about 285 years in the time of accumulation.

Since the wood burned is not known the 0.9 per cent ash yield from fires must be regarded as approximate, especially since chemical analysis and current practice differ. Yet here again a small variation produces a great difference in the "age." One-tenth of 1 per cent variation might change the time of accumulation 410 years.

Finally, the estimate assumes continued residence on the site. If residence were for part-time only, the "age of the mound" would be increased proportionally.

In illustration: Suppose two of the samples analyzed are replaced by two samples taken from the same strata in the mound. The average percentage of ash would then become about 10 per cent and the "age" would be decreased 855 years. Or if instead of a mixed lot of wood, only willow and cottonwood, such as grew nearby, were burned the ash residue percentage would be reduced to 0.6 per cent. Bone and other burnt material not the residue of wood fires may also be eliminated, reducing this figure, say, another 0.1 per cent to 0.5 per cent, and increasing the "age" 1640 years. Finally, if residence on the mound was for only six months each year, the "age" would be doubled.

MATERIAL CULTURE

ARTICLES OF ASPHALTUM

We use the term "asphaltum" to designate an adhesive material used as a binder or glue, such as asphalt, bitumen, and other viscous tar-like matter. All specimens of adhesive material were not tested. In one case pine pitch was used (1-25550). Fish glue might also have been employed, but generally it would seem that asphaltum would be favored because other materials would be more difficult to procure than asphaltum, which occurred on the eastern side of San Francisco bay and in many other places in California.⁶⁶

This asphaltum was used for sticking beads to various articles, for covering wrapping (e.g., the cords on charmstones), possibly for producing decorative designs (e.g., whistles). One may infer a number of other uses. But as far as actual evidence goes the usage was more for aesthetic than practical purposes. It was used throughout the mound's history and the knowledge of it manifested in the earlier stages suggests a comparatively developed people.

⁶⁶ Andrew C. Lawson, *San Francisco Folio, Geological Atlas of the U. S.*, 23, 1914. *California State Mining Bureau, Minerals of California*, 285, 1923.

ARTICLES OF BONE

Articles of bone constitute the largest and most remarkable class in the material culture of the shellmound, but as a class are not so frequently associated with burials. They offer a variety of suggestive utilitarian forms and afford probably the most pronounced evidences of aesthetic traits.

The bones most often used were those of deer and elk and the wing and leg bones of birds. Traces of probable whale bone artifacts were recovered and it seems likely that fish bones may have been used but not preserved. Exceptional bones are noted as the different artifacts are discussed.

Practically all bones of size were broken. So many of these show absolutely no traces of use that it has been presumed that the bones were split for their marrow. In this study we leaned to the conservative side and unless a fragment showed indisputable signs of having been worked or used, it was not counted as an artifact. Uhle considered a number of such fragments as the "most primitive ethnological implements of which we have knowledge."⁶⁷ This seems aside from the point for evidence is available which shows that these primitive forms, if such they are, existed alongside much more developed forms which in the author's view must characterize the cultural horizon. In other words, Uhle believed that these primitive forms fitted in with the conception of a more primitive culture in the lower levels whereas our evidence shows that primitiveness and lower levels cannot be correlated.

Bone artifacts were found in all parts of the mound, but so frequently not in association with burials that most of our specimens from the cone were not found *in situ*. The careful work in the trenches produced proportionally more specimens. Does this indicate that in the lower portion of the mound we have the manifestation of a difference of culture? Probably not. From the cone, 175 bone artifacts were listed, of which only 55 (31 per cent) were found with burials. In the trenches 138 were recovered, of which 7 (5 per cent) were with burials. The inference is that without the conspicuous markers furnished by burials we missed a great many bone artifacts in the cone and that this accounts for the difference in relative abundance seen in our collection.

The bone artifacts generally suggest utilitarian uses, which may help to account for their exclusion from burials. Some of the forms

⁶⁷ *Op. cit.*, 71.

are readily identified but others, particularly those which we have brought together under Type IV of awls, cannot be determined.

A few pieces show incised decorative attempts, others show traces of bead work or string adornment. The whistles may be considered musical instruments. No other class shows so much attempt at aesthetic expression.

Astragali

From the cone there were recovered two astragali or knuckle-bones from the ankles of deer each of which had had a hole drilled through it (pl. 43, *mb*, 1-26457). It seems probable that a number of other astragali were not distinguished by us as artifacts. The use of astragali as dice or as part of a game has a remote antiquity and a wide distribution not only in the old world but apparently also in the new, although it is not entirely clear that its presence in the new world is not due to Spanish influence.⁶⁸ It is by no means certain that the drilled astragali from the Emeryville mound were implements for games. They might have been used as catches on the ends of cords or for other practical purposes. The depth of one of the pieces, 23 feet, seems to preclude Spanish influence. Astragalus bones are known to have been used by the Pomo Indians some fifty miles north of the bay and also by the Piman tribes in Arizona and Sonora.

Awls

The most common type of bone artifact is a pointed implement. Pins, needles, bodkins, punches, weapons, flakers, shell-openers, etc., might all be included. These articles merge into one another and into true awls so gradually, and actual indication of their use is so generally lacking, that our awl class is quite arbitrary. It is subdivided into eight types on the basis of the bone used. To some extent the bone employed and the use to which the awl was put were probably related. Compare, for example, the typical deer ulnae awls (pl. 38 *a-e*) with the cannon bone awls (pl. 38 *h-l*), or with an awl such as shown in plate 38*q* (1-25749). Many awls recovered are too fragmentary to be classified. For distributional consideration these have been thrown into a miscellaneous group. Type IV invites particular attention. Many articles quite different from the ordinary awls are found here, e.g., possible knives, scrapers, marrow spoons.

⁶⁸ Stewart Culin, *Chess and Playing-cards*, Rept. U. S. Nat. Museum 1896, 826-30, 1898.

A vertical cross-section of the trenches shows that all the different types had practically the same distribution, that this distribution was quite even, and that artifacts of this awl type extended from top to bottom of the mound.

Type I. Of ulnae.—Thirteen pieces in the trenches. These are blunt, strong awls usually made of the ulnae bones of deer (pl. 38c, 1-25737), although elk is also used (pl. 38a 1-25735), and one specimen of probably coyote ulna (pl. 38d 1-25739) was found. The elk specimen illustrated was one of the largest found (200 mm. long) and the deer specimen illustrated, one of the smallest (120 mm. long). Other specimens are shown in plates 38e and 38 b (1-26079, 1-26081). These tools have an excellent natural handle and are so sturdy that they must have been used for the heaviest work.⁶⁹ They might even have served as daggers.

Type II. Of cannon bones (metacarpals and metatarsals).—This formed the most numerous type of awls. They were generally long (ca. 115 to 185 mm.), well jointed, and highly polished. Four subtypes were recognized determined by the way in which the bone was used.

(a) Sometimes the bone was split so as to divide the knuckle. These where the knuckle end was the handle make up this subtype. Plate 38h (1-25756) shows a finished awl and plate 38g (1-25780) a bone used for this purpose. Five pieces classified. (b) Sometimes the non-knuckle end of the cannon bone was preserved as a handle, the bone being split as in (a). Plate 38k (1-25760), and plate 38m (1-25781) show a bone in process. Fifteen pieces classified. (c) In one case, from Area 10 at 10 feet, the entire knuckle was left for a handle; see plate 38f (1-25764). (d) Lastly, small fragments of the bone would be used with little or no preparation; see plate 38l (1-25762); two pieces classified.

In addition to the classified pieces 13 specimens were indeterminate, making a total of 36 for this type. These were horizontally distributed as follows:

Subtype a	5	Areas 2, 3, 8, 10, 14
Subtype b	15	Areas 3, 3, 5, 14, 17, 18, 19, 32, 36; trench 1, 2; trench 2, 4
Subtype c	1	Area 10
Subtype d	2	Area 8, 9
Indeterminate	13	

All the trench specimens that could be identified were of subtype b. A very sturdy awl was found 28 feet 9 inches deep (pl. 38j 1-26092).

Type III. Of tibiae.—Identification of these bones is more doubtful. Practically all awls in this class are made of deer tibiae. Specimens range in length from 95 to 195 mm. There is considerable variation of

⁶⁹ Compare Heye, fig. 12, *op. cit.*, 87.

form. Plate 38*p* (1-25748) shows what might perhaps be called a typical piece. Plate 38*n* (1-25745) is curved, very sturdy, and very highly polished. Plate 38*q* (1-25749) is interesting because of the very short point on such a large fragment of bone. In plate 38*o* (1-25752) we have shown one of the abundant fragments out of which awls of this type might have been made.

Type IV. Of deer rib.—Artifacts of this type are usually made of deer rib though this is not always the case. These articles are proportionally plentiful and are hard to classify. It seems certain that the extremes which we have included must have been used for very different purposes. Yet the interchange of characteristic features is so uncertain that no line can well be drawn. Knives, skin-scrapers, and smoothers are probably included. Some may have been hair ornaments.⁷⁰ Some features are common to all. There is a definite polished point although this point may vary from straight to curved or flat to round. All are relatively thin. This thinness has been obtained in a number of cases by grinding down the inner surface of a deer or elk rib (1-25788). They generally have a definitely finished base (pl. 39*j*, 1-25789).

Plate 39 *i-r* shows a number of these artifacts which were probably actual awls; *o* (1-25785) has a round point and a rather gouge-like cross-section. It also has the curve of the rib; *j* (1-25789) has been mentioned as illustrating the finished base, in this case rounded. It is quite flat and thin and it was associated with a burial and a number of other artifacts in Area 10 at 15 feet; *i* (1-25790) suggests the same type as 1-25789 with which it was associated. However it is much larger, having a width of 30 mm. It is sturdy enough to have been an effective weapon; *r* (1-25799) shows some of the abundant raw material. Whether such pieces had or had not been worked or used it seems impossible to state; *k* (1-26101) displays how the rib has been cut to a taper. This piece has a high polish on the outside and the inside has been ground down; *l* (1-26105) is part of an awl from 30 feet 6 inches deep; *m* (1-26106) illustrates a curving point; *n* (1-26112) has a squared somewhat concave-convex base; *p* (1-26113) has a rounded base and certain scratches on one side which seem entirely meaningless. The other side is ground down. Sixteen pieces like these came from the cone and 15 from the trenches.

Twenty-one articles intimately connected with the above and obtained from the trenches are illustrated in part in plate 39*a-g*; *g* (1-26116) shows a shaped base rather faintly suggesting a spoon. Note the reduction in the width of the specimen toward the middle; *f* (1-26123) also shows the reduction in width near the middle as though from wear; *d* (1-26122) is only the base of an interesting piece. The corners are shaped, the end square, and the whole piece only about 1 mm. thick. This is probably not rib bone. There is a hole in it about 5 mm. diameter, 60 mm. from the base. One of the truck-drivers recovered a piece which this may have resembled. It possessed the hole, was thin, curved, very

⁷⁰ Heye, *op. cit.*, pl. 61.

long, and pointed. Nelson secured a similar piece at Ellis landing (1-11214); *e* (1-26129) is unusual both on account of its base and the indication of decoration. At the base the piece has been beveled off for some 50 mm. and made somewhat concave. These bases may have been used for extracting marrow. Four incised lines appear at the broken end (reverse of plate). This specimen was 25 feet 6 inches deep; *c* (1-26131) suggests a scraper. The base is quite sharp and somewhat concave-convex. The bone is 2 mm. thick and has been ground down on the convex side at the base apparently to give the base an edge; *a* (1-26134) suggests a knife; *b* (1-26135) suggests a spoon.

Type V. Of sea-otter penis bones.—These bones were frequent and two from the trenches had unquestionably been used as awls (pl. 38s, 38r, 1-26137-38). The last piece is much worn down as though it had been sharpened many times. These may have been used as flakers, as was done in the Aleutian islands.

Type VI. Of bird bones.—Bird bones presented many doubtful cases. In very few cases did a detailed examination of the bone result in a conviction that it had been intentionally sharpened or polished by use as an awl. The fragile character of the bone itself makes it difficult to imagine what type of work they could have been used in. Plate 39*h* (1-25820) made from a radius bone and 190 mm. long seems almost certainly to be an awl. It is possible that such an artifact was used in extracting marrow. From Area 19. No awls of this type were found in the trenches.

Type VII. Of fish bones.—Awls of this class were scarce. One reasonably certain specimen is shown in plate 43*d* (1-25819). This may have been a needle. It came from Area 33 at 15 feet. Fragments of polished sting-ray bone suggest the same use.

Type VIII. Of uncertain bones.—Most of these bones were mammal and probably 95 per cent were deer. In the cone we secured 15 specimens. Plate 43, *a* and *b* (1-25806 and 1-25814), show rough splinters which have had a point polished by use; 43*c* (1-25807) shows a very thick, blunt specimen that suggests a special use. Another heavy specimen is plate 42*a* (1-25818) from Area 5. This was probably made of deer humerus. It is 105 mm. long. From the trenches 21 specimens of this type were secured. Plate 42*c* (1-26141) is a calcined basal fragment which shows considerable trimming of the bone.

Beads

A number of the bird bone pieces described later as tubes may have been used as beads. We have taken length as the distinguishing characteristic. All tubes are beads if less than 25 mm. long. In the trenches were five such pieces; in the cone, two. All these are shown in plate 43, *j-n*.

	Trench	Depth
43 <i>j</i> , (1-26182)	1	24' 3"
43 <i>k</i> , (1-26183)	2	25'
43 <i>l</i> , (1-26184)	3	26' 9"
43 <i>m</i> , (1-26185)	3	29' 10"
43 <i>n</i> , (1-26186)	3	30' 9"

Specimen 1-26184 is 20 by 8 mm. and there is a second shorter bead thrust into it. Specimen 1-26185 has two olivella disc beads still stuck to it with asphaltum. These are apparently the remains of more elaborate decoration. The presence of these beads, particularly the comparatively complex ones just described, in the lower depths of the mound should be emphasized as they are important in determining its cultural level.

Plate 43, *a* and *p*, show the two pieces from the cone, while *q* and *r* are so long as to rank as tubes but are shown here to illustrate the arbitrary line between these and beads.

A portion of what was apparently a large bone bead was seen. It consisted of half a ring, 30 mm. diameter with a wide groove in its edge. This piece seemed to have been cut out of deer bone and is evidence of considerable skill.

Club or Sword

Plate 42*g* (1-26194) presents a very remarkable fragment. It seems to be the handle end of a club or sword fashioned from bone. The grip is well made for the purpose and the edge is much battered from use. This interesting piece came from the bottom of the mound—29 feet 10 inches deep in trench 3.

Fishhooks

See this caption under "articles of Horn," page 226.

Fleshers or Saw-like Implements

A common implement of which 27 identifiable specimens were found was made by notching the scapulae of deer and elk (pl. 40 *a-m*). The blade is too thin and too brittle to have served as a saw for wood or hard materials; also the teeth are spaced too far apart, are too irregularly placed, and frequently extend over too limited an area. The teeth are not worn on the ridges but on one side. At times when teeth were broken out or worn away the pieces were renotched and the resulting edge was much too wavy to permit sawing; see plate 40*g* (1-25727). In some cases more than one edge was notched; *i* (1-25730) shows two edges notched; *a* (1-26069) shows a piece where the other two ridged edges have been trimmed down to give the piece a better finish (see also *b* and *c*). The variation in the size of the notches is indicated by *h* (1-25731) and *f* (1-25723). A single article similar to the above is here included. It is also notched bone and the teeth are very fine (pl. 6*e* 1-25734), the piece is made of deer rib instead of a scapula.

These pieces were scattered throughout the mound and were never associated with burials. The 11 pieces found in the trenches make us believe that the 16 from the cone are only a small part of those present. These articles are very fragile and must have been easily broken. Many scapulae were seen which were too fragmentary to indicate whether or not they had ever been notched. It must have been an implement in common use throughout the history of the mound since a piece (1-26066) was found as deep as 29 feet in trench 1. If anything, the lower specimens (pl. 40*a-c*) indicate more care in preparation as shown by the trimming of the ridges above mentioned. Twenty-three of the pieces were of deer scapulae (pl. 40 *j-m*), the balance of elk (pl. 40 *d* and *g*).

Mr. Henry Schumacher (brother of Dr. Paul Schumacher) has stated to the author that some years ago at Pleasant valley; Nevada county, California, he saw an Indian who had notched the edge of a steel knife blade and was using it for fleshing hides. This Indian informed him that formerly such implements had been made of bone. For heavy skins the notched shoulder blades of deer were used; rabbit shoulder blades were used for mole and other light skins. Such implements are used on the inside of the skins. Mr. Schumacher identifies our specimens as similar fleshers. This use seems probable as the teeth adapt it for catching the particles of meat and fat. The wear on the sides of the teeth suggests the rubbing which would result from the fleshing operation. This seems to the writer a more probable use than the use in connection with weaving, which Uhle suggests.

Pieces of this type have a high antiquity. The Palaeolithic pieces shown by Wilson⁷¹ appear to be very similar. So also do pieces found by Mr. A. C. Parker at the Ripley Erie site in New York.⁷² Similar specimens were secured by previous San Francisco bay shellmound investigators and Uhle⁷³ notes them as being reported from Bavaria, Alaska, and Massachusetts. Our point in citing these distributional references is simply to show that both temporal and spatial distribution point to a fundamental use, such as preparing hides, rather than to a specialized or localized development.

Knives, Scrapers, Marrow Extractors, Hair Ornaments

See Awls, Type IV, page 216.

Miscellaneous

From the cone we obtained four artifacts, and from the trenches one, made from entire cannon bones of deer. These pieces were highly polished and had lightly incised upon them, without apparent arrangement, a number of lines or marks (pl. 42*b*, 1-25886). Similar pieces are used by the Yurok Indians of northwestern California in sifting acorn meal. The meal is placed upon a flat tray which is tapped with these bones, effecting a separation of the fine and coarse material.

An elk's cannon bone (1-25890) split in half suggests an implement for dressing skins, or perhaps an awl in course of manufacture (pl. 42*d*).

Plate 42*f* (1-26195) presents another unique object recovered from the dump. This is 165 by 52 mm., has a very high polish, and looks much like a modern shoe-horn. A spoon or ladle is suggested. This piece is made from a broad piece of unidentifiable bone.

Needles

Bone needles were found though in very limited quantities which might be due to their size. Plate 43*g* (1-25826) shows a bone fragment 5 mm. long with a notch around the base. This was from Area 28. A highly polished basal fragment of an apparently similar piece was recovered from the dump. A few additional specimens were gathered by others.

In trench 1 at 26 feet 4 inches the knobbed-end specimen shown in plate 43*e* (1-26165) was found. In trench 2, at 23 feet 8 inches, was a

⁷¹ Thomas Wilson, *Prehistoric Art*, Rept. U. S. Nat. Mus. 1896, 376, pls. 13, 14, 1898.

⁷² The Archaeological History of New York, N. Y. State Illus. Bull, nos. 235, 236 (1920), fig. 43, pl. 97, figs. 10, 11.

⁷³ *Op. cit.*, 76-78.

specimen 66 mm. long by 2.5 mm. thick, with a drilled eye (pl. 43f, 1-26166). A very similar one came from 26 feet in trench 3, and from 27 feet came a similar piece with the eye started on both sides but not yet drilled through.

Pins

In trench 2 at 23 feet 9 inches to 25 feet 10 inches were four small bone pieces which we denote as pins. Plate 43h shows the base of one of these (1-26162) and plate 43i the point of another (1-26163). A number of the small awls discussed under that head were probably used as pins in preparing hides, etc.

Saw-like Implements

See Fleshers.

Sting-ray Bone Objects

Awls of sting-ray bone have been mentioned. These fish were apparently very plentiful in the bay near the shellmound probably because of the food available in the shellfish beds in the vicinity. They were represented in the mound principally by their dental plates, of which, relatively, there was a great quantity. It was suggested at San Miguel⁷⁴ that they were used as artifacts. They look so well fitted naturally for some use that one is tempted to think they might have been used; but not a vestige of direct evidence was seen. Many of the pieces certainly were not used since in a number of instances several plates were still in place together when found. The sting-ray barbs may have been used. Here again direct evidence of shaping or wear is lacking. But a burial at fifteen feet in Area 10 furnished suggestive evidence in the form of a cache of forty or more of these barbs gathered together.

Teeth

With burial 12-3619 at twelve feet in Area 6 were two beaver teeth plate 43bt (1-25895). These had not been drilled but were associated with bead and abalone work near the skull. This seems to indicate that they were held in esteem. Uhle also found beaver teeth and he thought their presence was an indication of antiquity for he believed the animal to be long since extinct in the neighboring territory. One

⁷⁴ Heye, *op. cit.*, 110-111 (Heye identifies the species as *Myliobatis californianus*).

of the men working for us had caught beaver in a skunk trap within about fifty miles of the mound on the lower Sacramento-San Joaquin river as late as 1918. And they exist at present in the Mokelumne river near its junction with the Sacramento. Hence their presence indicates no particular age.

Many sea-otter teeth were obtained. The large canines were frequently found isolated but with nothing about them to indicate use. However, one specimen was seen, but not recovered by us, which had been notched at the end as though for a cord for suspension as a pendant. Uhle illustrates in his figure 36 (1-8736) a bear's tooth used in the same way.

Deer jaws with the teeth still present were common. We saw nothing about any of these to suggest artifacts. A. C. Parker thinks similar ones were used as scrapers at the Ripley Erie site in New York.⁷⁵

Tubes

A large number of bird bones, principally ulnae, occurred in all parts of the mound. While they might have been intended as raw material for tubes, whistles, etc., we have adopted the view that they were normal refuse unless definitely worked. The work which converted such pieces into our "tubes" was the cutting off and grinding square of one or both ends. In addition "tubes" often showed a definite polish. Plate 41*d* (1-25865) shows a typical piece. The diameter of the tubes depended on the bone used. Since in cases (pl. 41*f*, 1-25881) this was as great as 20 mm., the inference is that some large birds such as pelicans, condors, and eagles must have been available at times. There was a great variation in length, 1-25865 is 60 mm. long; 1-25881, 85 mm. long. Plate 41*m* (1-25871) shows a piece 15 mm. diameter by 35 mm. long; plate 41*c* (1-25872), one 125 mm. long. The longest was 195 mm. The most delicate specimen, plate 41*e* (1-25880), was 100 by 5 mm. It was the only worked radius bone tube noted and there is a reasonable doubt as to its having been worked.

These tubes had a wide horizontal and vertical distribution in the cone, and six were found in the trenches, the deepest at 26 feet. One of these, plate 41*a* (1-26188), is 195 mm. long. The piece shown in plate 41*b* (1-26189) from 23 feet 6 inches has beveled ends and is probably not bird bone.

⁷⁵ *Op. cit.*, 293.

In the nature of the case it seems doubtful if these tubes were a finished product. They were probably articles in the process of manufacture. The short tubes suggest beads or game bones, the longer ones pipe stems, whistles, or the like.

Plate 41*i* (1-25884) presents an interesting specimen. It is the distal end of the femur of a large bird which has been provisionally identified⁷⁶ as a bald eagle. The end has been cut off probably for the purpose of making a tube of the missing portion. Other distal ends are shown in plate 41,*g* and *h*.

Only three tubes were noted which were not of bird bone. These are shown in plate 41, *j-l* (1-25885). They are well matched in size (115 by 13 mm.), workmanship, and material, and were found together and with the fragments of some exceptionally large bird bone tubes (pl. 41*n*, 1-25873). The material of the three tubes is uncertain; it is probably deer.

Whalebone Artifacts

A number of fragments of whalebone were recovered which had been ground down on one side. It was possible in one case to reconstruct a slab *ca.* 150 by 200 mm. The smooth, uneven surface indicates an artifact that had seen much use. Other pieces had been polished on both sides but are too small to permit speculation. This material was badly decomposed and it is quite probable that whalebone was utilized to a greater extent than these fragments indicate.

Whistles

By whistles we mean bone tubes as above described but with a notch in one side (pl. 41 *o-w*). They might also be termed calls or flutes. In some cases plugs of asphaltum were found in the vent and there are indications that one end was plugged or wrapped around with asphaltum, but we have no whistles with such actually in place. The vent was comparatively small and in no case was there more than one. It was apparently made by abrading rather than by drilling. In most cases it is rubbed so smooth that no tool marks can be distinguished. About thirty-seven of these whistles were found in the cone. The number cannot be stated exactly on account of the fragmentary condition of some specimens. In the trenches only four pieces were discovered. A remarkable thing about their distribution is the fact that they seemed to run in groups. Of the total thirty-seven pieces no less

⁷⁶ By Miss Edna Fisher, of the Museum of Vertebrate Zoology, University of California.

than twenty-two complete pieces and some fragments were found in three lots, all with burials, i.e.: Area 6 at 12 feet, 8 pieces; Area 10 at 15 feet, 9 pieces; Area 31 at 16 feet, 5 pieces. On this basis a single whistle-burial found in the trenches would have brought them quite into line with the cone. The distribution in the trenches ranged from 23 feet to 26 feet 10 inches deep. The grouping of these whistles together is curious. Does it indicate specialization in making or in use or neither? In two cases the burials were accompanied by other artifacts. Many of the whistles are fragmentary in these groups, and as some if not all the pieces were near at hand it is possible that they were "killed" at the time their owner was buried.

Another interesting feature about the whistles is that many of them show attempts at decoration. This was apparently done with asphaltum, red paint, wrappings, and beads. Plate 41*v* (1-25835) shows one of the group from Area 6. This piece is 195 by 11 mm. Seventy millimeters at one end have been blackened. Plate 41*s* (1-25836), found in the same group and 155 by 11 mm., shows blackened areas alternating with lighter ones as might have resulted from thongs or cords wrapped about it. Still another from this group (pl. 41*t*, 1-25837) shows a diagonal design in black lines. Two others though not colored still bear the imprint of olivella disc beads (*ca.* 5 mm. in diameter) which had been stuck to them. Plugs recovered from these whistles are apparently asphaltum (1-25842). The occurrence of so many of these whistles together and the marks of lashings suggest the possibility that two or more were bound together in use, somewhat in the manner of those found by Schumacher on Santa Catalina island,⁷⁷ or perhaps more neatly with cords to form double whistles like those used by the Hupa Indians of northern California and illustrated by Wilson.⁷⁸

The group from Area 10 also showed traces of asphaltum markings and red paint. Plate 41*r* shows 1-25845 (195 by 15 mm.) and 41*q*, 1-25846 (150 by 8 mm.) from this group. Some of the pieces in this group were curved with the notch on the concave side (e. g., pl. 41 *o-p*, 1-25848-49). These pieces seem so well matched as to again suggest the possibility of their having been bound together to form one instrument. The group from Area 31 contains one fine large specimen 210 by 11 mm. (pl. 41*w*, 1-25855). The others are fragmentary. The pipes and pendants associated with this burial make it unusual. Plate 41*u* (1-25861) shows a piece 185 by 11 mm. with well indicated black markings.

⁷⁷ Report of U. S. Geological Survey west of the 100th Meridian, VII, 237, 1879.

⁷⁸ *Op. cit.*, pl. 73.

A very problematical piece is presented in plate 42j (1-25891). This is a piece of a large bone (deer or elk, or perhaps human) with a hole in it looking like an unfinished whistle vent. Whether this hole was gnawed by animals or represents man's work is doubtful. If gnawed it seems strange that the gnawing would concentrate on so small an area and that no marks of teeth would show on other parts of the bone. It also seems strange that evidences of gnawing should be limited to this single specimen. On the other hand, scratches are observable farther from the vent than seems likely in human workmanship. Whistles made of large bones identified by Nelson as human femur⁷⁹ were found in a shellmound at San Rafael, across the bay in Marin county (1-14944-50). These seven pieces were marked with wrappings and asphaltum and two still have parts of olivella inlays (1-14947).

ARTICLES OF CLAY

No evidence of pottery was secured. (One very doubtful exception is noted below.) As this checks with previous investigations, it seems safe to say that pottery was unknown to the users of the mound.

In Area 1, a baked clay ball about 50 mm. in diameter (pl. 54d, 1-25543) was found. In trench 3, 26 feet 6 inches deep was a biscuit-shaped fragment of baked clay with an impression on the bottom such as might have been made by a pointed stick (pl. 54f, 1-25960). In the same trench at 28 feet deep was a small fragment of fire-baked clay 1-25961). Finally in trench 2 at 27 feet deep was a sun-baked or fire baked piece of mud or sandy clay so shaped that it somewhat resembles a portion of the rim of a vessel (1-25959, pl. 54e). Clay balls were made and used in the neighboring delta region where stone was scarce and the two specimens first mentioned may represent contacts with that region. Considering the uncertain shape of the other pieces and their great scarcity the author regards them as incidental by-products of some activity (e.g., cooking) and not intentional artifacts.

A clay mold of a textile is treated under "Textiles."

Articles of European Make

Articles picked up on the surface which were obviously of European make and which were likely to have accumulated through the use of the mound as a park were discarded. Beneath the surface no European artifacts were found.

⁷⁹ According to our re-identification these are not human but are elk bones.

ARTICLES OF HORN

Articles of antler or horn were comparatively numerous and were found in the trenches and in the central portion, edges, and perimeter of the mound. The material of the specimens has not been determined in detail but judging from skeletal remains the antlers most frequently used were those of deer.

Cups

The base of an antler cut off, hollowed out, and the edges beveled was found in two instances. The result was a cup-like object about 30 mm. in diameter and 55 mm. long. Specimen 1-26219 from a depth of 23 feet 9 inches is shown in plate 44*i*. Such an article is too small for practical every-day use. It may have been a container though no appearance of paint or other contents was found.

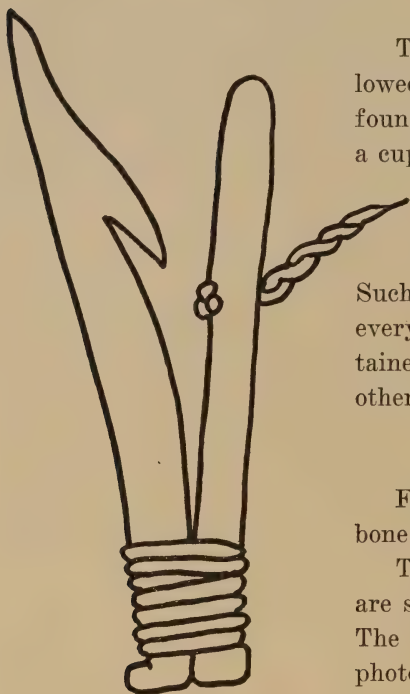
Fishhooks or Fish-spears

Fishhooks or spears are made of both bone and horn and are of two types.

The characteristics of the first type are shown in figure 4 and in plate 43*z*. The point and barb are broken in the photographed specimen (1-25907). The flattened edge where the hook was bound to the second member or to the shaft of a spear, and the notch for holding the

Fig. 4. Restoration of composite fishhook. Natural size of actual barbed elements (1-25907, pl. 9*z*).

binding in place are evident. Their resemblance to equivalent pieces in halibut hooks used by the Tlinkit Indians is so marked that their use as hooks seems reasonable. Only two specimens were found, 1-25907 at a depth of 12 feet in Area 8 and (pl. 43 *hp*, 1-25908) at 15 feet in Area 32. The latter is a fragment which gives evidence of a double barb. These objects do not seem to have been plentiful, although apparently they were not limited to one section of the mound. Plate 43 *fh* (1-26527) suggests a transition from this to the next type, having features of both.



The second type⁸⁰ of barb or hook is simpler. This barb is usually a plain, short, double-pointed piece (pl. 43 s-v 1-26170-73. See also Uhle, pl. 9, figs. 11-16). The pieces range from 45 to 90 mm. in length and are about 12 mm. in diameter. They are slightly convex in shape. In several cases the point at one end seems to have been worn smooth (fig. 5a). At the other end on one side for a distance of *ca.* 15 mm. is a somewhat roughened area (fig. 5c); next a smooth area (b), then a second roughened area (c) and finally the smooth point. Heye (pl. 53) illustrates similar objects except that in his

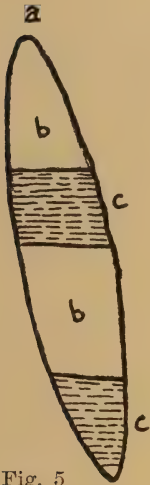


Fig. 5



Fig. 6



Fig. 7

Fig. 5. Double-pointed horn gorge or barb for composite fishhook (1-26170, pl. 9s). Natural size.

Fig. 6. Single-pointed horn gorge or barb for composite fishhook (1-26175, pl. 9w). Natural size.

Fig. 7. Outline of abalone ornament (not recovered). One-half natural size.

pictured specimens there are apparently only two areas, a lower blackened or rougher one and an upper smooth area. It seems probable that these blackened areas represent spaces covered by thongs and thus protected from wear. A covering of asphaltum might have further aided the blackening. A probable manner of use is illustrated and described by Heye.⁸¹ Our binding areas, however, make it seem impossible for the specimens to have been used exactly as illustrated by Heye; perhaps rather as the barb in the Eskimo composite hook.

⁸⁰ These articles are sometimes called gorges. For example, by W. J. Sollas, *Ancient Hunters*, 329, fig. 197b and c, where he shows Magdalenian artifacts of this type. It should be added that Uhle is more inclined to consider them arrowpoints, *op. cit.*, 74-76.

⁸¹ *Op. cit.*, fig. 10, p. 83-86.

In some cases these plain fishhook parts seem to have been modified without approaching the barbed type. Specimen 1-26175 (pl. 43*w*) has slight ridges (fig. 6*a*) where the blackened areas would be expected and there is a shallow notch (*b*) in the base. Specimen 1-26177 (pl. 43*x*) has the blackened areas but a tapered haft. The width (2 mm.) of this last specimen is so thin in proportion to the other dimensions (70 by 10 mm.) that it seems hardly strong enough for a fishhook. Also the upper blackened area seems too near the end.

All eight specimens of the plain type came from trenches 1 and 3. Number 1-26170 was at about the 30-foot depth in trench 1. The most shallow was at 23 feet 10 inches in trench 3. It is possible that this indicates that such hooks were characteristic of the lower portion of the mound although small pieces like these would likely be missed in the steam shovel work.

Plate 43*y* (1-25909) illustrates a doubtful specimen which is discussed under "Fork-like implements."

Flaking Tool

A long (165 mm.) tip of an antler (pl. 42*e*, 1-26220) with the portion near the point very much notched and scarred and the other end smooth as though from handling was found at 29 feet 10 inches in trench 3. This piece is longer and perhaps more pointed than the ordinary flaking tool but it suggests that implement.

Fork-like Implement

A portion of a fork- or hand- or trident-like object (pl. 43*y*, 1-25909) was found associated with skeleton 12-3769. In size and shape it greatly resembles the Chinese "back-scratchers," the shaft being missing in the specimen recovered. Sollas⁸² suggests that very similar Magdalenian pieces are gorges or fishhooks. We were inclined to agree with this classification until we examined a similar piece (1-11172) though with 4 "fingers," pictured by Nelson⁸³ from Ellis landing. The shaft of this specimen is also broken but it is too long to fit the gorge conception. Nelson suggests that the piece is a scratcher, such for instance as might be used during the period when, on her initiation into womanhood, the Indian woman is forbidden to touch her head with her hand. The great antiquity of similar pieces militates against such a localized, ceremonial interpretation. Further, the ends

⁸² *Op. cit.*, fig. 195, p. 328.

⁸³ *Op. cit.*, pl. 46, fig. 1.

of the piece show no wear such as would be expected were it used as a scratcher, but on one side there is a definite bevel apparently from such wear as might result from pushing the piece back and forth as a skin-smoother.

Miscellaneous

A number of fragments of antler were found in the trenches which gave definite evidence of having been worked on but were either unfinished or the waste ends. In some cases these were the cut-off tips, in others the base, and again medial fragments, cut off at both ends. The cutting was done by notching about as a boy would cut a stick with a dull knife. One piece (1-26221) was rectangular, having been cut on all four edges, and suggested a gorge in process of manufacture. The tips might have been unfinished pendants such as described below, and the basal fragments intended for "cups." One medial fragment (1-26223) is particularly interesting inasmuch as it came from 31 feet deep in trench 1.

Pendants

Plate 43 *pd* shows a flat, oval, horn pendant (1-26196) found 27 feet 7 inches deep in trench 3. This is the only specimen of its kind that we found.

Pieces of antler (1-26528 and 1-25905) which might have been pendants are shown in plate 43 *k, l*. These are natural tips (43*l* is *ca.* 60 mm long by 12 mm. diameter at base) somewhat hollowed out at the base and with a transverse hole drilled through the base. Arthur C. Parker pictures a similar piece, except for the transverse hole, from Ripley, New York, and thinks that it may have been an arrow head.⁸⁴ Number 1-25905 was found with a skeleton not recovered 15 feet deep in Area 27. Number 1-25906 (plate 44*j*) is possibly such a pendant in course of manufacture, or perhaps simply a discarded tip.

Wedges

The most common artifact made of horn was the wedge (pl 44 *a-g*). In the steam shovel work 8 were found distributed pretty well through the central portion of the mound. In the trenches 18 pieces were discovered. These articles were not with burials, with the exception of one (1-25904) in Area 32, 12 feet deep; and more should have been found in the cone unless they were used to a greater extent in the era

⁸⁴ *Op. cit.*, pl. 99, fig. 8, 296.

represented by the trenches. A few of the pieces, e.g., 1-26208 (pl. 42*i*) are comparatively long, show marks or scratches on their beveled points, and have ends so little battered that they suggest other uses than wedges. They might have been used to open shellfish or as flakers. One specimen (1-26210, pl. 44*h*) 120 mm. long, being flat and more or less pointed at both ends, may have been a large gorge.

These wedges may be divided about equally into two types.

Type I of which 1-25897, plate 42*h*, is a typical example is a comparatively long natural spike of horn with the tip more or less beveled. The length varies from about 100 mm. to 165 mm. and the diameter from 25 to 50 mm.

Type II is a short length of horn cut off at one or both ends. One end shows a decided bevel and the other end is usually battered from hammering. The lengths range from 75 to 90 mm. and the diameter from 25 to 60 mm. The usual size is about 30 mm. diameter. The piece 60 mm. diameter (1-26013) is an unusually sturdy one, the length being 90 mm. Plate 44 *a, b* shows typical specimens (1-25898 and 1-26200).

The distribution between the three trenches was quite even as was the vertical distribution. The deepest wedge found was at 29 feet 8 inches in trench 3. This was a flat piece 120 mm. long by 45 mm. by 22 mm. Regular wedges, however, were at 28 feet 3 inches in trench 1 and at 27 feet 9 inches in trench 2.

It may be observed that most of the battered wedges are too short to be gripped in the whole hand and struck. Also no mauls were found for pounding the wedges.

ARTICLES OF SHELL

In actual number of separate artifacts articles of shell exceeded all other materials. It seems obvious, however, that one should count one string of beads rather than several score of individual beads, or one necklace rather than half a dozen pendants, etc. Even so, the quantity of shell artifacts in the Emeryville mound was still relatively plentiful; but when the location of the site is recalled and the region compared with other regions the scarcity of shell articles is impressive.

Here were a people located on a bay of the ocean procuring much of their sustenance from the sea and handling hundreds of pounds of shell annually. Yet of the forty-one bodies found in the lower part of the mound only eight were associated with shell artifacts. (See table 6.) A similar comparison for the upper part cannot be made

for data do not exist for all the burials there. From table 5 it may be noted that out of sixty-eight cases of observed association between bodies and some form of artifact, fifteen instances were entirely without shell. In other words, while table 5 shows that shell was the most commonly associated artifact, it gives no suggestion of the percentage of total burials without shell. Otherwise, one might conclude that the use of shell was much more general in the latter part of the mound's history. The allowable conclusion seems to be that although shell was the most common non-decomposable material used for ornamentation, apparently not more than 25 per cent of the population possessed shell articles. Further, in most cases the amount possessed was small in quantity. Compare, for example, the few beads found with the Emeryville bodies, with the yards of beads which frequently accompany the bodies in the Sacramento-San Joaquin delta region thirty to fifty miles away.

The poverty of form is almost as striking as the lack of quantity. In the region just referred to the abundance and elaborateness of abalone ornaments is striking. In the Santa Barbara Channel region shell was worked up into a surprising variety of forms, as Heye has indicated. Here at Emeryville one would not be far wrong in grouping all shell objects under two heads: beads and pendant-like objects. The exceptions would be rare and unimportant. Moreover, most of the beads are of the two simplest forms known, the olivella whole-shell and the olivella circular disc bead, although another form did exist in appreciable quantities, i.e., the olivella rectangular disc bead. All the pendants are of abalone shell. Practically all are very simple in form and are rather poorly made. In a limited number of cases attempts at decoration were made. Such attempts consisted either of incising the edge of one side, or of parallel, circular, incised lines.

It seems necessary to account for this paucity of shell artifacts. The first suggestion is that raw material was not in fact as available as at first seems evident. Local shells were apparently not suitable. The olivella and abalone shells used were open-sea shells. To reach the open sea from Emeryville would have required a tedious march of three or four days around the southern end of the bay. An even more difficult march and the crossing of Carquinez strait would be involved in a northern trip. The direct way would be ten miles across the bay to the Golden Gate. Accordingly, the conclusion is that the aborigines did not possess the means or the ability to make such a trip frequently. Yet, if such an explanation is valid, how did it happen that the delta region, more or less behind these people and much farther from the

sea, possessed so many more shell artifacts? Again, the abundance of shell-work reflects the economic status of the people. The Emeryville people had few shell articles because they did not have the means of acquiring such articles through trade.

Shell articles were practically always with burials; and, as has been stated, were the most common burial association. Although so associated they were never "killed." This non-killing of ornaments which could be more easily stolen than other forms of wealth implies that the practice of breaking up certain of the deceased's possessions had already become a definite ritual, and that one is far from the beginnings of such practices.

From the viewpoint of horizontal distribution, shellwork emphasizes the localization of certain types of artifacts. For example: practically all the *haliotis* shell beads were with one burial; the ring-type *olivella* bead (pl. 45 *j, k*) was found only in the northwest perimeter;⁸⁵ rectangular discs (pl. 45*s*) came only from Area 6; abalone ornaments (pl. 45 *p, q*) were only with burial 12-3738. The distribution of pendants is noted in detail later. Such a distribution may indicate the differences of different makers, or, having a wider basis, which the presence of exceptional pieces (e.g., fig. 7) supports, may lead back to the conception of various groups from different localities visiting the mound.

Vertical distribution does not suggest an evolutionary development during the history of the mound. The practice of inlaying was apparently known from its very beginning. Changes in types of artifacts are noted but these seem equivalent to the horizontal localizations just commented on. For example: the pendants most elaborate in form (type V) do not appear below twenty-two feet deep. But the most elaborately decorated pendants are all from below that level. The occurrence of rectangular *olivella* beads is suggestive. These beads appear to be a more advanced product than the circular type. They were found only above seventeen feet deep (from 9 to 17 feet to be exact). Apparently the rectangular type is later and did not reach the mound until it had attained half its growth. That it was an intrusion rather than a local development is suggested by the two styles of rectangular beads. These two styles were used as complementary parts of a whole and it seems unlikely that, so related, they would have sprung simultaneously from the circular bead.

⁸⁵ A number of similar beads were recently obtained from a site on the Orinda Country Club golf course. This site is over the first range of Berkeley hills and about ten miles from Emeryville.

Beads

Shell beads were found throughout the mound from 6 feet to 29 feet 6 inches deep. In practically all cases they were associated with burials. As there is every reason to think that they were present in many of the burials not carefully examined, suitable data for comments on distribution do not exist. For convenience in discussion we consider only articles less than 17 mm. in diameter as beads; if larger they are discs or pendants. Beads are first classified according to the material of which they are made, and then according to form.

Beads of abalone (Haliotis) shell.—With a burial at 15 feet in Area 8 were a number of centrally perforated abalone pieces varying from circular to rectangular in outline (1-25616, pl. 45 *a, b*) and about 15 mm. in diameter. These were associated with larger abalone discs and with olivella beads. In Area 20 with skeleton 12-3680 at 15 feet was a similar bead (1-25617).

Beads of mussel shell.—Three disc beads *ca.* 7 mm. diameter (1-26053, pl. 45*c*), found at 26 feet 10 inches with skeleton 12-3783 in trench 1, seemed to be of mussel shell. With them were sixty-five or more olivella beads of the same type. It is possible that other beads made of mussel shell were not distinguished by us, but we are more inclined to think that this was an exceptional material.

Beads of olivella shell.—Beads of this material are of three types.

Type I.—These are whole olivella shells with the spires ground off. Plate 45 *d, e* shows a typical specimen (1-25628). Twenty-six lots were recovered. The average bead is from 10 to 13 mm. long; but pieces as small as 6 mm. and as large as 25 mm. were seen. In one lot (1-26057) the range was from 7 to 25 mm. and it seems probable that they were strung or arranged in some kind of a design. Another lot (1-26058) of more than one hundred pieces was well covered with red paint. The beads were all about 22 mm. long. This large number of large beads seemed to have been sewed on a cape or garment of some sort which covered the shoulders and upper portion of an infant (12-3793). Another infant (12-3794) which lay at the same level (24 feet deep) and about four feet away was also accompanied by a large number of these beads (1-26059). The lowest shell bead found was of this type—a single bead at 29 feet 6 inches (1-29061).

Type II. Olivella disc beads.—These are the common circular bits of olivella shell, ranging in diameter from 2.5 to 15 mm., and centrally drilled with a biconical hole. Plate 45 *f, g* shows a typical specimen

(1-25654). Thirty-eight lots were recovered from the cone and only three from the trenches, which appears to indicate a relative scarcity of the type in the lower portion of the mound. All beads of this type found were with burials. Moreover, it was the most common association and was frequently the only artifact that appeared in a burial. But in many cases it was associated not only with other artifacts but also with other types of beads. In some cases they were present in lots of 500 to 1000 pieces and were probably not all recovered even then.

The position of the beads was usually near the head, sometimes apparently haphazard as though strung and wrapped around the skull, and in still other cases "shingled" or set in position as though they had been sewed on something. In most cases a head covering or ornament of some kind was suggested though in a few cases a necklace or shoulder covering might be implied. Beads were also found in the mouth and ears.

Some of these beads were in such poor condition that it was impossible to handle them; on others the luster was still bright. Some were covered with red paint, some showed traces of asphaltum or other material forming a yellowish film; some were perfectly clean. Condition and depth had no discernible relationship.

Three styles or subtypes of these beads may be readily identified. There is first what may be termed the regular style wherein the diameter ranges from 6 to 15 mm. In the larger ones there is a marked curvature (natural in the shell) and the outline is somewhat irregular. The smaller beads are much flatter and the outline is more even although it may range from circular to almost rectangular. The second style consists of the "inlays or bushings." Diameters here are from 2.5 to 6 mm. The beads are quite flat and the whole is proportionally large. Plate 45 *h, i*, show a typical specimen (1-25659). Beads of this style were scarce (4 lots recovered). Also they are far from being the only beads used in inlay work. For example see Uhle's plate 2. Style three is almost a ring. The bead is well made and the hole is very large proportionally and does not disclose biconical drilling. The specimens (78) are too definitely true to style to permit the assumption that they are accidental forms. This style was found only in the northwest perimeter of the mound where three lots were recovered. Plate 45 *j, k*, show a typical specimen (1-25682).

Type III. Rectangular olivella beads.—These beads, also made of the walls of the olivella shell, offer interesting contrasts to the circular

bead. Generally speaking, they show a great deal more skill, having good straight edges and square corners. The hole is placed with more care and as nearly as can be determined it is drilled from one side only. Plate 45 *l, m*, show a typical specimen (1-25688). Twenty lots were recovered at depths ranging from 9 feet to 17 feet. One lot (1-25693) contained over 700 pieces. None, it will be noted, came from the trenches where the circular beads were also scarce. These rectangular beads were frequently used in overlay or shingling, their position in the work being often visible. In at least three cases this inlay was on the skull, suggesting a head covering (e.g., 12-3702).

There is some variation in sizes of these beads. The largest was 8 by 10 mm. and the smallest 3 by 6 mm. The most striking difference in form, however, consists of the relation of width to length. In one group of beads, by far the most numerous, the width is more than half the length, in others it is not and the beads appear slender. A comparison of plate 45 *l, m* (1-25688) and *n, o* (1-25699) will make the difference clear. Such difference was doubtless intentional for the two styles were utilized in producing designs.

Discs

The distinction made here between a pendant and a disc is simply that the disc is not perforated. The only shell discs recovered were made of abalone (*Haliotis*) shell. Their distribution was limited and all were associated with burials. Two types may be considered.

The first type (pl. 45s, 1-25598), which is of a generally rectangular shape, was the most numerous (12 lots recovered). Sizes range from about 47 by 48 mm. to 55 by 75 mm. The two shorter edges are often decorated with light notches. All pieces of this type came from Area 6 at depths of from 9 to 13 feet. In one case (1-25600) the pieces were over the face of a skeleton (12-3618), and in the other cases the association with the head was intimate.

The second type is made up of circular pieces (pl. 45t, 1-25610). The distribution is more uneven as we obtained one lot from each of the following areas, 8, 10, 26, 31. The depths were from 10 to 16 feet. In all cases the edge appears to have been decorated by notching.

No. 1-25618 (pl. 45r) gives an indication of what may have been a common practice—the ornamenting of a disc by setting olivella disc beads thereon by means of asphaltum.

Miscellaneous

Six rectangular ornaments of abalone shell (1-25619, pl. 45*p, q*) found with burial 12-3738 at 13 feet are out of the ordinary since they are drilled at both ends and one piece has six holes.

With three different burials large open-sea clam (*Schizothaerus nuttallii*) shells were found. No other such shells were seen in the mound. In one lot (1-25707) were five pieces. This appearance only with burials would appear to indicate that these shells were indeed rare. This conclusion is made reasonable by the fact that this species is not found in the bay waters and must have been obtained from the seashore outside the Golden Gate. On the hinge of one of the valves barnacles have grown, which would seem to indicate that the shell, not the shellfish, had been collected by its former possessor. In all, these shells suggest visits to the open sea but at the same time imply the rarity of such visits.

A similar suggestion is offered by a salt-water mussel shell of a species not common in the bay which was obtained in trench 2 at about 25 feet. Of course abalone shells also had to be obtained on the seacoast.

Pendants

The only shell pendants found were made of abalone (*Haliotis*) shell. They were found only with burials and generally over the eyes or face. In almost every instance the pieces were exceedingly fragile and consequently a number seen could not be recovered and many of those obtained are in fragmentary form. The holes are usually biconically drilled. All abalone pieces seem to have a stain (or patina?) of a brownish hue. This will wash off.

In considering distribution the concentration in a few burials should be noted. For example, twenty-two pieces of abalone (all pendants) were identified in the trenches. In the same trenches were forty-one bodies. Of these six had abalone associated with them as follows:

Skeleton 12-3784, 6 pieces of abalone; 12-3789, 8; 12-3792, 2; 12-3793, 2; 12-3794, 1; 12-3814, 3. It will be seen from this how treacherous quantitative or distributional generalizations are likely to be.

Pendants may be divided on the basis of form.

Type I. Rim type.—This type of pendant is made from the heavy rim of the haliotis shell, and preserves some of the crescentic shape of that rim. One specimen (pl. 46*a*, 1-25557) of this type was found with skeleton 12-3662 in Area 18 at 3 feet. It is 13 by 110 mm. and is drilled at one end. Other pendants of this type are shown in Heye, plate 78.

Type II. Dagger type.—These pendants are long, slender, somewhat dagger-shaped, and drilled at the non-pointed end. A typical specimen (pl. 46*c*, 1-25568) has a notched design around its inside (nacreous) edge. Sixteen pieces were found of which five were from the trenches, the deepest pieces (1-26032-33) being with skeleton 12-3784 at 26 feet 8 inches deep. Three were with skeleton 12-3814, one of which was very slender and the other quite broad. In the cone, specimens ranged from a depth of 3 feet to 15 feet and came from the following areas: one each, Areas 20, 21, 24, 36; two each, Areas 10 and 26; three, Area 6. In two cases (1-25567-26036) there were two holes in the specimens instead of one.

Type III. Rectangular type.—This type (pl. 46 *e, f, g, h, i*, 1-25570-71, 1-25576) generally has straight sides and square corners. It is variable in size. The end is not pointed. The hole is in different places. No specimens of this type were found in the trenches. Those in the cone were distributed as follows: depths 8 feet to 15 feet—one each in Areas 9, 35, 36; two in Areas 6, 21, 36; four in Area 20. Some specimens are decorated with the light notches around the edge. Specimen 1-25574 has the drilled hole in the center, 1-25575 has two holes at one end, and 1-25576 has three holes at one end.

Type IV. Rough outline.—This type is represented by the specimen (1-25577) shown in plate 46*j*, from Area 26 at 4 feet. The distinguishing feature is that the outline is not only irregular but it is not shaped.

Type V. Irregular outline.—In this type the outline is irregular but it is shaped and is inclined to be symmetrical. The base is broad, the top more slender with two projections somewhat like horns. Plate 46 *k, l* show a typical specimen (1-25579). The edge is usually decorated with notches, the hole is in the base, i.e., the broad end. In some specimens there is more than one hole (1-25580, pl. 47*k*, 3 holes in base; 1-25584, pl. 47*o*, 5 holes at top and one at base; 1-25585, pl. 47 *m, n* 4 holes in top). No pieces of this type were found in the trenches. The distribution in the cone was: depths 8 feet to 17 feet—one each in Areas 19, 25, 31, 32, and four in Area 9. The most

elaborate specimen of this type noted by us was recovered by others. It is shown in outline in figure 7. Pendants somewhat of this type are common in the San Joaquin-Sacramento delta region.

Type VI. Circular type.—This type is distinguished by being circular or oval in outline. The diameter ranges from 17 mm. to 60 mm. The inside edge is nearly always notched (pl. 46 *p, r, s*). The hole is usually near one margin. One specimen (1-25596) was noted with three holes. Plate 46 *m-o* show characteristic specimens (1-25587). Plate 46*p* had some adhesive material (asphaltum?) around the rim (1-25592) suggesting an inlay with olivella beads like that more definitely shown in plate 46*q* (1-26044). Plate 46 *r, s* (1-25595) show a large size. Distribution in the cone was: depths 8 feet to 16 feet—one each in Areas 20, 35; two in Areas 9, 26, 31; three in Area 10; six in Area 32; ten in Area 36. The distribution in the trenches has been touched upon in the introductory remarks to pendants. Skeleton 12-3789 was not only supplied with a number of abalone pieces but they showed variety. Plate 46*t* shows specimen 1-26038. This specimen is about 60 mm. diameter with a 7 mm. hole. It is incised with two pairs of roughly parallel lines about 3 mm. apart on the lustrous side. This design is interesting because it is the only one used for decorating the abalone pieces except the slight notches above mentioned. Another specimen (1-26039) with skeleton 12-3789; two (1-26044-45) with the infant 12-3792; one (1-26049) with the infant 12-3793; and a very similar design (1-26051, pl. 46*u*) with 12-3793 represent the most definite attempt at design that we saw. It is interesting that such an attempt appears in the lower levels (24 feet to 25 feet 11 inches) and the similarity supports the supposed relationship between articles of this general level in the trenches. The location of the pendants about skeleton 12-3789 was as follows:

1-26038, incised line design, central hole, 60 mm. diameter.....	In crotch.
1-26039, incised line design, central hole, 42 mm. diameter.....	In abdominal cavity.
1-26040, two small marginal holes, 40 mm. diameter.....	Near right knee.
1-26041, central hole, 35 mm. diameter.....	Under pelvic bones.
1-26042, central hole, oval, 20 x 15 (2) mm. diameter.....	Under ribs.
1-26043, central hole, 30 (2) mm. diameter.....	Near left knee.

See burial 12-3789 for further comments.

A variation of the circular type wherein the central hole is so enlarged as to make the piece a ring was noted. Four specimens were

near the head of skeleton 12-3784. The diameters and holes were 35 x 15 mm.; 25 x 15 mm.; 35 x 20 mm. A similar piece, 30 x 15 mm., was found with the infant 12-3793.

Vessels

Five more or less entire abalone shells (*Haliotis californiensis*) were recovered, two in association with burials. These may have been raw material, or they could have been used as vessels, containers, scoops, etc. (See Heye pls. 73, 74, fig. 22, fig. 23.) One specimen (1-25621) apparently had olivella disc beads stuck to its inside; 1-25622 showed some evidence, in the form of light notches, of having been worked; 1-25624 was soiled as though by previous contents.

ARTICLES OF STONE (CHIPPED)

Arrowpoints, Spearheads, and Knives

Form.—The artifacts of this class found at Emeryville may be grouped on the basis of form as follows:

Type	Characteristic form	Plate 48	Quantity
NAa	Not stemmed, leaf-shaped, pointed at both ends.....	<i>h</i>	2
NAa(?)	Probably same as above but specimens incomplete.....		5
NAb1	Not stemmed, leaf-shaped, pointed at one end, convex base.....	<i>f</i>	4
NAb2	Not stemmed, leaf-shaped, pointed at one end, straight base.....	<i>g</i>	2
NA—	Not stemmed, leaf-shaped. Further determination impossible.....		2
SAa	Stemmed, contracting stem, shouldered only.....	<i>a</i>	2
Unidentifiable fragments.....			9
			26

This tabulation is based on the scheme followed by Gifford and the author in working up material from the upper San Joaquin valley.⁸⁶ There it was necessary to develop eighteen regular types and several special ones for classification. This is in marked contrast to the situation at Emeryville where consideration will show that there are even fewer types than would seem apparent from the table. As many of the specimens were poorly made or damaged by use, detailed classification is difficult so that it is probable that all the NA group specimens listed should be taken as having been intended for the same type of point. It will be noted that these differ only with

⁸⁶ Archaeology of the southern San Joaquin valley, present series, XXIII, 1-122, pls. 1-34, 1 map, 1926.

reference to one end, which may be sharply pointed, convex, or straight—a neat distinction to make in many cases. A number of the unidentifiable fragments are parts of large, rather than small, blades and hence also probably of the NA group. In short, it would appear that we would commit no essential error if we decided that the Emeryville inhabitants used but two types of chipped stone arrow-points or spear points; (1) a small, stemmed type (SAa) which occurred very infrequently; and (2) a larger, leaf-shaped, non-stemmed type generally pointed at both ends (NAa).

Type SAa.—The two specimens found are both comparatively small (1-25505, pl. 48*a* and 1-26006, pl. 48*b*). This smallness coupled with the fact that they are stemmed and shouldered leads one to regard them as arrowpoints. The collections of Uhle, Nelson, and Loud bear out the fact that the stemmed type was much less frequent in the bay district. In the Alpaugh region of the upper San Joaquin valley the non-stemmed type predominated. In the lake region of the same area type NBb (non-stemmed, triangular, concave base) constituted 45 per cent of all points. In the Dalles region of the Columbia river, type SB (stemmed with parallel-sided stems) constituted almost all the points. Attention is called to the heavily serrate edges of 1-25505.

Type NAa.—Plate 48 illustrates a number of these points (1-25452, 1-25455, 1-25456, *d-f*, type NAb1; 1-25457, *g*, type NAb2; 1-25451, 1-25460, 1-26000, *h-j*, type NAa). These are large, sturdy points as a rule; so large, indeed, that it seems impossible to regard them as arrowpoints.

Material.—Of the twenty-six points, twenty-three were made of obsidian and three of a deep chocolate-colored, white mottled flint. This flint is quite different from the chert which was common in the mound in the form of raw material. No points were found made of that chert. These flint blades were fragmentary but appeared to be of the same type, i.e., NAa (1-25997, pl. 48*k*). All were from the trenches, two from trench 2—one at 23 feet 8 inches deep and the other at 23 feet 5 inches deep with skeleton 12-3795; the third from trench 1 at 26 feet 9 inches deep with skeleton 12-3791. They appear to represent an early intrusion which was not subsequently repeated. Obsidian, the usual material for these artifacts, does not occur locally. The nearest supply was probably some distance north of the bay. A few pieces of raw material were found in the mound in the shape of water-worn obsidian pebbles (1-2546, pl. 54*i*). As these were found associated with burials, more than ordinary value was evidently placed

upon it. Obsidian chips were noted here and there, one from as deep as 29 feet 6 inches. The chips from their smallness and scarcity suggest breakage in use rather than an indication of the manufacture of points. All in all, one is inclined to think that these points were brought in or traded in from the north where they were made.

Workmanship.—The workmanship exhibited by the points is fair at best.

Distribution.—The distribution of the flint points has been noted. We now take up the twenty-three of obsidian which may be tabulated.

Area	Depth	Quantity	Association
General surface.....		3	_____
Area 6.....	13'	1	With skeleton
Area 6.....	13'	1	With skeleton 12-3616
Area 6.....	?	1	_____
Area 8.....	?	1	_____
Area 17.....	13'	1	With skeleton
Area 26.....	11'	2	With skeleton 12-3708
Area 33.....	16'	2	With skeleton
Area 40.....	?	1	_____
Trench 1.....	26' 4"	1	
Trench 2.....	24' 9"	1	With skeleton 12-3800
Trench 2.....	25' 10"	6	With skeleton 12-3801
Trench 2.....	29' 7"	1	_____
Trench 3.....	27' 7"	1	_____
		23	

Fourteen of the twenty-three were found with skeletons. Since the others were not all found in place it is probable that nearly all, if not all, these points were originally buried with bodies. This concentration is very remarkable and is emphasized by the six pieces (nearly 30 per cent of the total found) with a single burial (12-3801). In other words, the entire collection from the mound points to less than a score of users of such points. Even allowing for what was overlooked and taking a minimum age of 1000 years for the mound this paucity of hunters or fighters equipped with such simple weapons is indeed extraordinary. This scarcity of points is an outstanding feature of the bay mounds. The results of the investigations of Uhle, Nelson, and Loud are more or less analogous to our own. These are artifacts usually collected by "relic hunters," yet even by the early settlers in this district the scarcity of points was noted.⁸⁷ Such artifacts are usually comparatively plentiful in aboriginal sites in California which have been dealt with archaeologically. The abundance

⁸⁷ Thompson and West, Historical atlas of Alameda county, 15, 1878. "The arrowheads found here are usually of obsidian." There is a "scarcity of weapons of warfare."

of similar points in the counties north of the bay again leads us (as did the material) to attribute the origin of the Emeryville points to that region.

The fact that a goodly portion of these points were actually left in the wounds (pl. 48o) of the individuals with whom we found them shows that they were not the property of the person buried. This lends weight to the hypothesis of their foreign origin, suggesting that they were brought in by enemies and left as the result of fights. In this way, it is likely that other points as well came into possession of the mound-dwellers.

The horizontal distribution indicates a rather widely distributed use.

The vertical distribution is more interesting. Number 1-26006 (pl. 48b), as well worked a piece as any found in the mound, was from a depth of 29 feet 7 inches, another from a depth of 11 feet. Apparently then, knowledge of obsidian points was possessed from the earliest days of the mound to well toward its end. When such a piece as 1-26006 occurs practically on the bottom of the mound the question as to whether or not chert chips were eoliths seems aside from the point.

Usage.—As has been suggested only two or three of the points found seem suitable for arrowheads. Since points were made but arrowheads were not, we conclude that the bow and arrow was not popular. The other points could have been used as knives or spears. The fact that 1-26004 (pl. 48l) was apparently held in the hand of skeleton 12-3801 during a fight suggests its use as a knife or dagger. On the other hand, the nature of the wounds inflicted makes the use of these points as spears seem more probable. Number 12-3801 might have grasped the head of his enemy's spear in the course of the fight. Spears were apparently more popular than the bow and arrow. Our evidence would further suggest that they were used in war rather than for hunting. Indications of slain game are plentiful and if chipped stone had been used for this purpose it should be more abundant. The lack of such weapons in hunting might help explain the practical absence of any skeletal material of bears and other carnivores which were numerous in the vicinity.

Scrapers and (or) Knives

Only two articles of this class were found (1-25450, pl. 48*p*, and 1-25998, pl. 48*q*). Both are of the type that have a shaft or handle, i.e., more or less gouge or chisel-like.

Specimen 1-25450 was made of gray chalcedony, 1-25998 of greenish chert. This last piece is of particular importance since it is the only specimen made of the chert material plentiful in the mound in its raw state. This may have been because the material was hard to work or it may indicate that chipped implements were usually made in some other spot where a more suitable material (notably, obsidian) was available. The amount of chert of this nature in the mound has been mentioned and the possibility of the chips being eoliths or the refuse of a workshop has also been discussed. Hence it may simply be repeated here that if this chert was as widely worked into artifacts as the chips would suggest if made by man in manufacturing points, knives, etc., it seems remarkable that only a single specimen representing such manufacture should be discovered.⁸⁸ It is possible that on account of its brittle nature the aborigines in making scrapers tried to substitute tougher materials for obsidian which was generally used for their points.

The workmanship exhibited by these specimens is fair.

Specimen 1-25450 was found in Area 25 at eleven feet deep not in association with anything. Number 1-25998 was 25 feet 10 inches deep in trench 2, with skeleton 12-3801, with which were also associated six obsidian points. This gives the contemporaneous use of obsidian and chert. The chalcedony was found at a depth of eleven feet. Apparently from the beginning both chert and obsidian were known to be suitable for chipped implements. Obsidian was preferred and other material used only infrequently or for special objects. The material from Stege and Ellis landing indicates the same practice there.

⁸⁸ A possible exception to this statement is 1-8815 found by Uhle. This is a portion of a point made of red chert. Uhle's specimen 1-8929, possibly an awl, was made from a chip of quartz. Uhle's other specimens we would call chips, not artifacts. See his pl. 6.

Loud found only one flint artifact at Stege as against 11 obsidian ones. At Ellis landing the proportion of non-obsidian artifacts was low, although Nelson does not give exact quantities.

TABLE 9

EMERYVILLE MORTARS

Type	I	II	III	IV	V
Diameters	Upper and lower about equal	Unequal; lower smaller	?	Greatest diameter at neither top nor bottom	Uncertain
Height	Much less than diameter	Much less than diameter	?	Less than diameter	Less than diameter
Sides	Concave	Straight	?	Convex	Irregular
Lip	Flat: square corners, outward slope	Flat: square corners; no outward slope	?	Rounded and thin	None
Rim	ca. 40 mm. thick	25-40 mm. thick	?	ca. 25 mm. thick	Small hole in large pebble
Base	75-150 mm. thick	40-100 mm. thick	40-100 mm. thick		
Bottom	Flat	Flat	Flat	Rounded	Irregular
Usual size	Over 400 mm. diameter	150-510 mm. upper diameter	Lower diameter 300-400 mm.	Medium	Extremes
Finished	All over	All over	All over	Exterior indifferently	Inside only
Workmanship	Excellent	Good	Good	Fair	Poor
Illustrated	Plate 49b	Plate 50a	Plate 50b	Plate 50c	Plate 49a
Typical specimen	1-25323	1-25531	1-25337	1-25343	1-25349
Quantity recovered	3	23	7	10	8

ARTICLES OF STONE (GROUND)

Mortars

Forty-seven mortars were recovered in the steam shovel work, and four from the trenches. A number of other mortars were noted but were acquired by others. It seems probable that practically all the mortars in the cone were observed and that the number was not far from 80, or one mortar to about seven bodies.

With the exception of three pieces in Area I and one in Area 30, the thirty located pieces were from the areas within the hedge. Nine were from Area 10; otherwise the distribution was rather even. Data for vertical distribution are insufficient. The highest was 7 feet, the lowest 28 feet 6 inches deep.

Most of the mortars were made of basalt or fine sandstone. Mortars of unidentified stone were also noted but none of granite were seen. This material suggests either the neighboring Berkeley hills or the mountains north of San Francisco bay as sources of supply.

In size the mortars varied greatly. The smallest was 90 mm. diameter; the largest 500 mm. diameter by 290 mm. high. The great majority were about 300 to 400 mm. diameter. The smallest piece (1-25914, pl. 54*m*) was also from the lowest depth (28 feet 6 inches) and was associated with a pestle.

On the basis of form we have divided the mortars into five types. Characteristic features of these are given in table 9 and typical forms displayed in plates 49 and 50. Since these types converge it is difficult to classify some specimens. Type III should perhaps be more properly included in the other types.

Type I.—Specimens of this type seen are of porous, gray basalt. The superiority of workmanship should be emphasized. The symmetry of form and the excellent finish, taken in conjunction with the large size, implies a most thorough mastery of technique and a very high degree of mechanical skill. Six mortars of this type were noted and three recovered, one each from Areas 10, 30, 35.

This type is also reported from Sonoma county just north of San Francisco bay.

Type II.—Mortars of this type were generally made of the Franciscan basalts or sandstones. The workmanship was in many cases excellent but more variable than in type I. The lower diameter is

frequently very much smaller than the upper. The size varies greatly. The next to the smallest specimen found (150 mm. diameter by 120 mm. high) was of this type. Also the largest diameter noted, 510 mm., was of this type. This was the most popular type, twenty-three out of fifty-one classified specimens belonging to it. These were quite evenly distributed.

Type III.—These are “killed” mortars, i.e., mortars deliberately broken, presumably at the time of burial of their owners. That the breaks are deliberate is adduced from these facts. The pieces broken off the sides resemble one another in size and shape so as to suggest their having been broken off by similar strokes from the same implement, e.g., pestle. They vary from three to eight to a mortar. In several cases pieces were discovered near the broken mortar which fitted it, indicating that it had been moved little if any after the breaks were made. The number of similarly broken mortars seems to preclude accidental breaking. This breaking has been used as the criterion for classification. All these specimens, however, belonged to types II or IV before being “killed” and it seems probable that most of them were type II. Specimens found were scattered in the central portion of the mound.

Type IV.—This type is meant to include the bowl-like specimens. The sides are usually definitely convex though sometimes they are straight. The base is also variable for while it is usually more or less rounded or pointed, specimens with a flat base were found. The quality of workmanship is also variable. As a rule the exterior is not symmetrical and is not well finished. Ten specimens were found, one each from Areas 1 and 10, two from Area 9; three from the trenches; and three uncertain. This seems to indicate a limited distribution in the mound.

The type is particularly interesting because of its frequent close association with human bones. In several cases part of the skull or skeleton was actually in the mortar (1-25354); or it was on the chest (1-25911 on 12-3784); again it was inverted over the skull (1-25912 on 12-3817). In this last instance a second, similar mortar (1-25913) was inverted over the pelvis. These are only typical instances as other cases where specimens were not recovered were noted.

Excepting a small “paint”(?) mortar the only mortars found in our trenches were three of type IV (the three last mentioned above) and these approached type II in having a flattish base and a fairly

well-shaped and finished exterior. Mortars of this type showed variation in material.

Type V.—These are mortars made from large pebbles, small boulders, or irregular masses of material. The hole is small compared to the mass of the mortar. The shape is irregular and the exterior is very slightly finished or more frequently not at all. The range in size is from large specimens to the smallest one (1-25914) recovered. The small so-called paint mortars are likely to be of this type. Number 1-25918 from 28 feet 6 inches in trench 2 is apparently a pebble in which a mortar was being started. Marks of red paint were all around the edge. The seven pieces found show an even distribution. The material varies as in type IV. Mr. E. J. Dawson of Lodi, California, states that small mortars of this type are most common in the Lodi-Stockton area.

Several mortars were noted with flattened areas on their sides (e.g., 1-25350, 1-25911) as though this area had been used in some grinding or polishing process. Many specimens had the rims worn into grooves as might be expected from pestle action, and two were seen where holes had been worn clear through the bottom by ordinary use. The small specimen 1-25914 has sides and a base which suggest a muller.

Mortar 1-25333 (type II) is particularly notable. This fine mortar had a design on its lip formed of various sized rectangular olivella shell beads set in asphaltum. Both the mortar itself and this decorative attempt reveal a marked aesthetic sense.

In addition to complete mortars a number of mortar fragments were collected from the trenches. Many of these had been used as fire-stones. These were found to the lowest depths and suggest naturally that mortars were used very early in the mound's history, perhaps at its very beginning, but also that they were used by a people familiar with them before they settled when the mound now is.

Pestles

Pestles of various stones were found throughout the mound—fifty-two in the shovel work and ten in the trenches. These may be divided into four types as shown in table 10.

Type I.—The longest piece noted had a length of 200 mm. The greatest diameter was 100 mm. Only one piece was found outside the central portion of the mound. Two were in the trenches: one

TABLE 10
EMERYVILLE PESTLES

Length	Type I		Type II		Type III		Type IV	
	Short and stout	Elliptical	Short and stout	Circular	Comparatively long	More or less circular	Comparatively long	Irregular
Cross-section	Same size; both used for		Slight or no taper; both		One end pointed: only one		Both ends used	
Ends	pounding		used for pounding		end used			
Typical specimen	1-25376		1-25380		1-25412		1-25420	
Illustrated	Plate 51b		Plate 51c		Plate 51a		Plate 51d	
Quantity	10		15		29		8	

(1-25923) near skeleton 12-3778 at a depth of 26 feet 7 inches; the other (1-25924) with mortar 1-25914 at a depth of 28 feet 6 inches. Both these are small (*ca.* 50 x 100 mm.) and 1-25923 shows red paint ingrained in the ends. Hence they were probably paint pestles.

Type II.—These ran in about the same sizes as type I. They were found on the edges as well as in the central areas. Six were in the trenches. One of these (1-26927) was imbedded in ash under the head of skeleton 12-3795. A fragment of another was one of the deepest artifacts found—30 feet 4 inches. It is possible that this type simply represents specimens of type III worn down by use. It is interesting to note that this type is most numerous in the trenches whereas such was not the case higher up.

Type III.—These were found throughout the mound and one rather flattish specimen (1-25932) was recovered from trench 2 at 28 feet 3 inches. Lengths averaged from 200 to 330 mm. and the average diameter was about 50 mm. Inasmuch as one end shows a tendency to specialization these might be regarded as the most elaborate pestles, but in excellence of workmanship they do not surpass many of the carefully fashioned specimens of types I and II. One specimen (1-25407) in its end specialization shows the so-called phallic end. It will be noted that this was by far the most frequent type.

Type IV.—These pestles are so irregular that it is often doubtful whether they were pestles or hammerstones. As both ends show use and the length is considerably greater than the diameter (maximum specimen 310 x 120 mm.) we have considered them pestles. They are natural pieces of rock and give no evidence of having been fashioned whereas types I, II, and III have all been shaped. Such specimens were found mostly in the western half of the mound. One specimen was recovered from trench 2 at 27 feet 6 inches.

In addition to complete pestles the number of pestle fragments (many of which had been used as fire-stones) in the trenches showed that this article was in common use in the early history of the mound.

Fragments of a pestle were noted which suggested that it had been "killed."

While the material of which the pestles was made is varied, there is nothing about it to suggest that it could not have been procured in the Berkeley hills.

Pipes

Form.—Six pipes, presumably for smoking tobacco, were secured. One is in fragmentary condition. The other five (1-25498-99, 25500-01-03) are shown in plate 52. All these pipes are of the tubular variety but no two are alike in detail and there is a tremendous range in size. Figure 8, giving the main outlines and comparative sizes, with plate 52, will best make these variations clear. Since practically all the pipes used in California, except in the northeastern part, are of the tubular type this feature is of little assistance. Pipes similar to 1-25498 (pl. 52*f*) are found in modern times in central California (e.g., 1-4083, Madera county). Numbers 1-25499 (pl. 52*e*) while differing considerably in proportions has about the same capacity and was apparently likewise adapted for the insertion of a bone stem or mouthpiece. Number 1-25500 (pl. 52*c*) resembles specimens from Santa Barbara. Nos. 1-25501 (pl. 52*b*) and 1-25503 (pl. 52*a*) resemble one another and are large, handsome pieces. On account of their size and material it is to be expected that they would resemble Santa Barbara channel types but they do not. Loud procured two specimens of similar form from the shores of northwest California. The five pipes secured by Uhle at Emeryville are also all of the tubular type and differ from one another and from ours. Hence they carry out the impression of entire lack of uniformity in these artifacts. Of the three specimens from Ellis landing one is cup-shaped somewhat resembling 1-25499 and the other two approach our specimens 1-25501-03 but are not the same.

Since three of these pipes (1-2500-01-03) were with one burial the three types represented were contemporaneous. Considering this fact together with the diversity of form, the questionable value of comparing our small series with those from other regions is emphasized. Pipe forms or ideas of them might have arrived through trade, but it seems clear that there was no predominant type and that individual taste and skill in manufacture were important factors. This indication is interesting when applied to such items as charmstones where the use is not definitely known and where the diversity in form has caused much speculation.

Mr. E. J. Dawson has kindly supplied me with data concerning the pipes in his collection from the Mokelumne-Sacramento river region and in the Barr collection from Stockton. Both collections exhibit the same variations as those commented on above. In both could be found specimens reasonably similar though not identical to those in our collection. While both collections are richer than ours, all our general comments concerning pipes would apply as well to this delta material.

Material.—Four of the entire specimens are of steatite as is also the fragmentary specimen. As four of Uhle's pipes and all three of Nelson's from Ellis landing were of similar material, it seems obvious that this was the favorite material for pipes in the bay region. Number 1-25500 is of fine grained sandstone; 1-25499 has been coated apparently with white paint or has acquired a heavy incrustation both

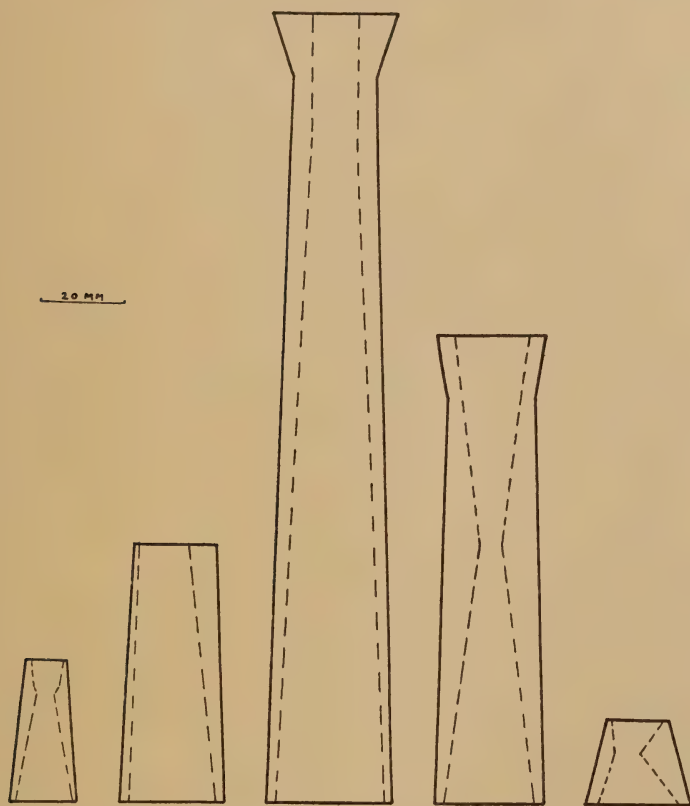


Fig. 8. Pipes. Diagrammatic drawing of outline and boring. See plate 18.

inside and out. The steatite of the other pieces does not resemble that found near Stege; this difference may be due to the fact that the pipes are highly polished.

Workmanship.—Considerable variation in skill is shown. In all cases except 1-25499 the exterior is well shaped. In 1-25499-500 the holes are eccentric (fig. 8); in others they are well done. The drilling was apparently from both ends except in 1-25500. Number 1-25498 (pl 52f) is incised with two rather poorly executed lines around the stem end; 1-25501 (pl. 52b) is ornamented with a deep, regular groove

where the neck swells to the mouthpiece. Specimens 1-25501-03 because of the sureness of execution and perfection of form are much superior to the other specimens.

In addition to the aesthetic effect secured by the worked stone itself specimen 1-25501 still bears the impression in adhesive material of two rows of small, rectangular olivella beads set around the neck near the mouthpiece. Number 1-25499 also has two circular olivella beads still stuck to its side. Whether these are remains of ornamentation that existed during the use of the pieces, or whether they indicate the preparation of the pieces for burial is not clear. In support of the latter view it may be noted that 1-25503 has a considerable amount of red paint adhering to it.

Distribution.—It is to be regretted that the series of pipes is so small that the several interesting indications it offers cannot be more strongly emphasized. The data may be tabulated.

Museum No.	Area	Depth	Associations
1-25498.....	26	11'	Skeleton and other artifacts
1-25499.....	27	15'	Skeleton and other artifacts
1-25500 }	31	16'	Skeleton and other artifacts
1-25501 }	31	16'	Skeleton and other artifacts
1-25503 }	31	16'	Skeleton and other artifacts
1-25533.....	32	17'	Skeleton and other artifacts

In the first place it will be noted that not only were all pipes with burials but that all such burials had other artifacts. This suggests that owners of stone pipes were people of more than ordinary importance. This is emphasized by the fact that three out of the five pipes were with one body. Nelson's pipes at Ellis landing were similarly associated but Uhle makes no mention of his pipes having been associated with burials.

Next it will be observed that all the pipes are from one region of the mound. However, Uhle's finds were in quite a different region although they were also localized. This horizontal distribution suggests that the pipes were brought in by groups who visited the mound occasionally and that all groups who visited the mound did not have stone pipes. In other words, it points to a non-continuous residence on the mound and the probability that the groups which frequented it came from divers places.

The vertical distribution will bear the same interpretation. Our greatest variation is from 17 feet to 11 feet deep. The time interval represented might well cover only the period when a given group was frequenting the site. Uhle's finds were all in his stratum II, i.e., 5 to 6 feet deep. So we have the same suggestion. At Stege no pipes

were procured. At Ellis landing two pipes were together and they were within 25 feet of the third one, horizontally but about 13 feet vertically—possible accounted for by the slope of the then cone.

This localization of pipes might bear an even closer interpretation to the effect that only a limited number of persons could possess stone pipes.

As far as the data go another conclusion might be drawn from the Emeryville pipes. No pipes were found lower than seventeen feet deep. This roughly corresponds with the level where plummet-like stones first appeared and the two facts support one another as evidence of a change in the culture of the mound. The objection is that as far as our finds go there were no pipes above eleven feet either, whereas Uhle found several at five to six feet. This fact together with the localization which has been noted makes one wonder if another trench dug in the base of the mound might not disclose pipes.

Usage.—It has been assumed that these were tobacco pipes. Number 1-25501-03 actually contained a quantity of ashes and charred material (1-25502-04). For none of the others can tobacco smoking be proved and considering their difference in form it might well be that some were used for some other purpose, e.g., by a sucking shaman.

It should be emphasized that in the above discussion stone pipes only have been dealt with. Wooden pipes were much used in California including the region north of the bay and it is reasonable to think that they were known to people residing on the mound. However no archaeological evidence whatsoever bearing on this subject was found. Accordingly the matter of tobacco smoking must be passed by since stone pipes and the custom of smoking cannot be taken as identical.

Plugs

Such a designation for the short cylindrical stone objects here described is highly speculative, but no better suggests itself.

From 13 feet deep, Area 6, came a highly polished sandstone specimen, cylindrical in form, about 26 mm. in diameter by 22 mm. high (1-25496, pl. 52*g*). The sides of this object are slightly concave. Uhle found a somewhat similar article (1-8671, his pl. 12, fig. 12). Nelson also found similar specimens at Ellis landing (his pl. 43, figs. 9 and 10). At 25 feet deep, Area 20, we found an artifact closely resembling the above but with a deep groove in the side rather than a slight concavity, so that it somewhat resembles a spool (1-25497, pl. 52*d*).

The only possible usage which we can suggest is that offered by Uhle—ear-plugs or labrets.⁹⁰ Their occurrence is so infrequent that the practice of using them could not have been very common and it seems possible that they came from the Sacramento-San Joaquin delta region.

Plummet-like Stones and (or) Charmstones

Form.—No absolute line can be drawn between stone artifacts which obviously fall outside and those which can best be treated under this heading. Such stones have aroused much interest because of their promising implications but no scheme for treating them on the basis of usage has been developed because the actual use for which they were made is still a matter for discussion.⁹¹ Accordingly, in a recent paper on the upper San Joaquin valley, E. W. Gifford and the author endeavored to develop a scheme for the classification of plummet-like stones which depended entirely upon their form. The major division depends upon whether or not pieces are perforated. Non-perforated pieces are then divided according to whether or not they have a pile at the end, i.e., a point formed by secondary curves rather than by a continuation of the primary curves. Subsequently subdivisions are based upon the character of the pile and the ratio of the breadth to the length of the piece.⁹² This same plan will be followed here. Many of

⁹⁰ *Op. cit.*, 59, 60.

⁹¹ For a succinct account of these articles and a bibliography the reader is referred to "Plummetts," Handbook of American Indians, Bur. of Am. Ethn., Bull. 30, Part II, 1910.

⁹² The form used for the upper San Joaquin valley, with the number of specimens of each type classified, is as follows:

	Per cent
D. Perforated	9.9
W. Not perforated	
A. No pile (i.e., no secondary curves at end)	
a. Spherical or egg-shaped (length not more than twice width)	
1. With grooving (longitudinal)	4.9
2. With notching (at ends)	1.2
3. Neither grooved nor notched	6.8
b. Spindle-shaped (length more than twice width)	
1. With horizontal groove	1.2
2. With notched ends	5.6
3. Neither grooved nor notched	6.8
B. With pile (i.e., end or ends show secondary curves)	
a. Pile at one end	
1. with horizontal groove	0.6
2. Plain	8.0
b. Pile at both ends. One end always plain and the other end:	
1. Plain	24.1
2. With shoulder	6.8
3. With button	8.0
4. With nipple	13.0
5. Notched	3.1
	100.00

the specimens obtained are too fragmentary to permit classification. Others though broken are so nearly complete as to render a given classification probable. Such specimens have been classified but the doubt indicated by a question mark (table 11).

TABLE 11
PLUMMET-LIKE STONES FROM EMERYVILLE (1924-25)

Type	Length		Diameter		Ratio		Number	Per cent of total
	Max.	Min.	Max.	Min.	Max.	Min.		
D.....							5	12.5
WAb3.....	163	127	33	28	1:5.8	1:3.8	4	10.0
WAb3(?).....							3	7.5
WBa2.....	220	100	40	25	1:7.9	1:2.5	5	12.5
WBa2(?).....							8	20.0
WBa3.....	95		35		1:2.8		2	5.0
WBa3(?).....							2	5.0
WBa4.....	143		30		1:4.8		1	2.5
WBb1.....	120	80	47	38	1:3	1:2	4	10.0
WC.....	35		18		1:1.9		1	2.5
Unidentifiable							5	12.5
							40	100.00

Type D. These are perforated pieces. No. 1-26015 (pl. 53c) is a typical piece. The hole is biconically drilled and is nearer one end. Three of the five specimens are notched at this end. (One is broken so that this feature cannot be judged.) Three pieces are irregular rather than cylindrical in form (pl. 53 *a-c*); one approaches the cylindrical (pl. 53d); and the fifth, a broken piece, suggests a slender flattened spindle. It will be seen that this class constitutes a small part (5 per cent) of the total and this relationship is borne out in other collections. None of the seventeen specimens discovered by Uhle were of the perforated type. At Ellis landing, at Stege, and in the San Joaquin valley the proportion of perforated pieces is about the same (5 per cent).

Type WAb3. These are specimens which are not perforated, which have no pile, and which are in general spindle-shaped; no. 1-25485 (pl. 53k) is a typical piece. A further characterization of this type is that the ends are plain, i.e., neither grooved nor notched. An interesting point is that the greatest diameter is nearer one end than the other whereas in the upper San Joaquin region the greatest diameter was near the center, thus producing a symmetrical piece. The relationship between this type and types WBa2 and WBa3 is close and it will be noted that the three constitute 60 per cent of all specimens. The same preponderance seems to hold good for the specimens found by Uhle, by Loud at Stege, and by Nelson at Ellis landing. Since the same is by no means true for the upper San Joaquin valley, where specimens

with a pile at both ends constituted more than half the whole, we seem to have not only a generic similarity for the specimens of a given region but a marked difference in detail when different regions are considered.

Type WBa2. This type (1-25463, pl. 53*p*) differs from the preceding in having one of its ends brought more abruptly to a point, producing a pile. The other end is usually somewhat longer than in the WAb3 type, is tapering, and sometimes ends in a slight swelling which if enlarged a little would produce a second pile, or type WBb1. Its abundance has been commented upon.

Type WBa3. This type did not occur at all in the upper San Joaquin region. In type WBa2 the pile was at the pointed end. Here the pointed end is without pile (1-25476, pl. 53*e*) whereas the plain end of the type WBa2 is swelled by secondary curves.

Type WBa4. This is also a type not found in the upper San Joaquin collections. The variation consists of a notch in the end with the pile (1-25488, pl. 53*j*). Since only one piece was seen it may be taken as an unusual variant.

Type WBb1. This is the only type of the class with pile at both ends and is the simplest form of the class. It is relatively scarce—10 per cent of the total. Specimen 1-25473*b* (pl. 53*f*) is typical.

Type WC. A single piece of quartz was found (1-25471) which had the shape of a "charmstone" and which was associated with a group of "charmstones." Hence we are led to classify it as such although, never having been worked, it is not identifiable with any of the classified forms.

Material.—On the basis of the material of which they are made the plummet-like stones found by us at Emeryville may be grouped as follows. In this table the Franciscan sandstone and basalts, which are difficult to distinguish without extended analyses, are grouped together.

Material	Number
Franciscan sandstone or basalt.....	26
Granitic.....	3
Limestone.....	1
Schist.....	2
Steatite and (or) greenstone schist.....	7
Quartz.....	1

Of Uhle's seventeen pieces from Emeryville one was steatite, and the rest were of the Franciscan formations; none was of granite. At Ellis landing 20 per cent were steatite, the rest of Franciscan formation. At Stege 20 per cent were of Franciscan formations and over 50 per cent of steatite. In material then, as in form, the plummet-like

stones of the east bay region show a generic similarity. Further, these materials point to local manufacture. All materials noted are obtainable within a few miles and the most common, the Franciscan formation, is that most commonly used. In fact these formations and the glaucophane schist are so typical of the Coast Range that the inference of local manufacture seems sure. The connection between the material of which artifacts were made and its local occurrence is emphasized by the large proportion of steatite at Stege, the largest known local deposit of that material occurring nearest to Stege.

No absolute connection between material and form is established but in the perforated type steatite or greenstone schist is very definitely used more frequently than any other material. The relation may be tabulated. Fragmentary and doubtful pieces are omitted.

Per cent of Type D made of	Emeryville 1924-25 °	Emeryville 1902	Ellis Landing	Stege
steatite.....	80	No type D	100	70
Per cent of steatite pieces which are type D.....	60	0	80	70

Apparently, then, this material was preferred for the perforated pieces. This might be accounted for by the fact that it was easier to drill. But this does not seem to explain why, when steatite was used, it was usually made up into perforated pieces. The connection may be due to usage. Stege was nearest the largest local supply of steatite and more than half of its plummet-like stones were of that material. It seems more reasonable to suppose that the Stege residents utilized the local deposit and made articles to be traded, if they were permanent residents, or took advantage of the opportunity afforded by the visit to make themselves up a supply, if they were transients, rather than to think that the existence of the raw material would have modified the habits of the people in the use of such plummet-like stones.

Workmanship.—The quality of workmanship is very uneven. Photographs tend to eliminate differences in finish but the grace, symmetry, and skill required in the production of such pieces as 1-25463 or 1-25474 (pl. 53 *p* or *i*) may be contrasted with the lack thereof illustrated by 1-25482 or 1-25487 (pl. 53 *d* or *h*). The steatite pieces, being formed of softer material, might be expected to exhibit the nicest forms. The contrary is true: the best forms are found in the Franciscan formations. Nor were the lowest (the oldest?) specimens the crudest. Rather the workmanship seems to have varied with the maker; and considering, for example, part of the group (1-25463-66, pl. 53 *m-p*) found with one burial, their uniform character suggests that the individual maker could have been detected by his work in his

time. Remembering, however, the limited uniformity and the few pieces produced by a given area, horizontal or vertical, it would appear that no one person made any considerable number of these articles. This suggests that certain men made one or more for themselves. The group of nine pieces indicates that sometimes a considerable number were made; but since no other find even approximated this, the ordinary quantity must have been only one or two. Whether or not these were subsequently passed from man to man or remained the peculiar property of the maker is not clear.

Little suggestion is offered by the articles as to how they were made. Several steatite pieces apparently in process of formation have peck marks on them which suggest that the piece was first roughed out by pecking. The symmetry of the cylindrical pieces indicates that the finishing was done by revolving them in a vertical position in a hole and the fine polish of some pieces suggests that this revolving was done with some mechanical aid—such as a fire drill. The pile could be produced by changing the size of the hole. On the whole, considerable ingenuity was required to arrive at the process but once discovered it seems probable that a handsome specimen could be turned out in a comparatively short time.

Distribution.—In the cone there were found thirty-six whole or fragmentary specimens which can best be classified as plummet-like stones. A number of pieces were secured by other people so that perhaps fifty in all were noted by us. In the trenches were four pieces. Of the thirty-six pieces obtained from the cone seventeen were definitely associated with burials in five groups, namely 9, 3, 1, 2, 2. Some of those found by others were also with burials. Since many were not actually obtained *in situ* and since all were found in the central areas⁹³ where burials were most frequent, it is probable that

⁹³ The horizontal distribution noted was:

Area	Associated with burials	Others	Total
?	9	4	13
1	3	0	3
6	1	1	2
8	0	1	1
10	2	3	5
22	0	1	1
24	0	1	1
25	0	2	2
26	0	1	1
29	0	1	1
32	0	1	1
33	2	0	2
35	0	1	1
36	0	1	1
39	0	1	1
	17	19	36

the percentage of association would run high enough to indicate that the great majority of articles of this type were found in the cone because they were buried with the dead and not because they were lost in the course of daily life. None of the four pieces found in the trenches were associated with burials.

Our data for vertical distribution in the cone are too limited to permit detailed analysis. Specimens were recorded from 6 feet to 20 feet, in the area where burials were most numerous. In the trenches a specimen was found at the 29-foot depth. Plummets-like stones were evidently known from the time the mound was begun; those of its earlier stages (i.e., from the trenches), however, may be contrasted with later specimens (those from the cone). The four specimens from the trenches may be characterized as follows:

Museum No.	Type	Depth	Material	Associations
1-26012	Perforated	Trench 1, dump when 29 feet	Steatite (?)	Isolated
1-26013	Perforated	Trench 2, dump when 29 feet	Steatite	Isolated
1-26014	Not perforated	Trench 3, dump when 22-23 feet	Sandstone	Isolated
1-26015	Perforated	Trench 3, dump when 27 feet 7 inches	Steatite	Isolated

The 22-23-foot level in trench 3 had been more or less disturbed by the steam shovel so that it is quite possible that 1-26014 came from the higher levels of the cone. The three pieces of which we are sure show a definite similarity (pl. 53 *a-c*). All are perforated, all are notched, all are of steatite, none were found in association with burials.

Further, these similarities set the group off from those in the cone. Of the thirty-six specimens there only two were perforated. One of these (1-25482, pl. 53*d*) was 20 feet deep, was made of steatite, was not found with a burial. On the other hand, in form it more closely resembles those in the trenches. The second perforated specimen (1-25494) is entirely different from any other. It is made of glaucophane schist and is in fragmentary condition but it suggests a slender spindle flattened on the sides and drilled toward one end. The depth at which it was found is unknown. In this same mound seventeen identifiable plummet-like stones were discovered by Uhle all from above the 18-foot level and all of the non-perforated types. In the trenches steatite is the uniform material; in the cone it is the exception. None from the trenches were associated with burials; most of those in the cone were so associated. In short, the homogeneousness of the lower group, and its contrast to the upper group, suggest that

the perforated specimens are objects of a different nature from the non-perforated ones, or that they are earlier forms of the same object.

Since the purpose of all these stones is unknown no criteria for possible differences exist, but certain possible uses can be considered which would appear more applicable to the lower, perforated stones than to those of the upper group. Sinkers for fishing is the first thing suggested. An objection to such a purpose is their elaborateness. Simpler pieces of more common material would have served the purpose as well and were actually used as specimens recovered show. Still the same reasoning would eliminate much of the modern fisherman's equipment. While the hole would have enabled the piece to be securely fastened to a line, there seems no purpose for the groove. Neither holes nor grooves show the wear of a cord which would be expected after use in fishing. The pieces might have been used for pendants as steatite was widely used for this ornament. The drilling in the smaller end suggests a pendant. It is true that they seem rather large for ornaments (1-26015 is 77 by 35 mm.) but Heye shows steatite pendants nearly as large from San Miguel island.⁹⁴ Also the perforated pieces are smaller and lighter than the non-perforated ones. It is possible that these perforated pieces were effigies. Number 1-26013 (pl. 53*b*) strongly suggests an animal's head, the hole forming the eye, the groove the mouth; 1-26015 (pl. 53*c*) might represent an entire whale, the eye and mouth being again represented and the tail set off by a heavy incised line. Putnam believed that he found effigies of whales in the Santa Barbara region,⁹⁵ and Uhle thought that one of the specimens (1-8850) he recovered at Emeryville was the effigy of a bird. That many specimens do not resemble effigies can be accounted for; but it would appear that better representations could have been produced by the aborigines if effigies were really wanted. If the specimens of the lower group were effigies we would have an explanation for the development of "charmstones." Magical qualities would no doubt be assigned to effigies and though the form might change the supernatural association would endure.

The author does not lean to the opinion that an evolutionary development is revealed by these stones, but the data may be arranged to support such a view. Only the perforated type which might have evolved from a pendant to an effigy or fetich was found in the lower levels. In its simplest form it is a drilled and notched pebble (1-26012, pl. 53*a*). In the secondary form such realism as had been attained

⁹⁴ *Op. cit.*, pl. 24.

⁹⁵ *Op. cit.*, 220.

is being supplanted by conventionalization and a more cylindrical shape is shown (1-26015, pl. 53c). In the third form all resemblance to the pebble is lost and the characteristic plumb-bob shape appears (1-25482, pl. 53d). (This specimen from 20 feet deep is the last of the perforated pieces as the higher levels are approached.) In the fourth step the hole is lost and a neck replaces it (1-25476, pl. 53e). From this point diverge the various more elaborate forms, usually through the development of longer pieces and an elaboration of an end. The objection to such a theory is that specimens may be arranged in such an ascending series in the laboratory but they were not found in the required temporal sequence (using depth as an indicator). For example, 1-25475 which is similar to 1-25476, our fourth step, came from the 6-foot level of the mound and was therefore above the types it should precede.⁹⁶

Turning to the non-perforated types we find that all of Uhle's identifiable specimens (17) were non-perforated and from above the 18-foot level. Excepting a single doubtful piece we found no non-perforated pieces below 20 feet. Apparently then at the time when the mound was 10 or 12 feet high a definite change occurred. One type was replaced by another, or at least a new type arrived on the scene. This new type was not rudimentary but came as a fully developed product which showed little subsequent refinement. Our interpretation of this would be that the people using the mound were replaced by newcomers differing from any previous inhabitants.

Usage.—Although there are transitional forms as has been discussed above in some detail, nevertheless there is a similarity about the shape of these pieces that must have been dictated by the practical requirements of the use to which they were put or which depended upon custom and traditional association. What such a use might have been has been discussed in detail by the authorities mentioned above. It is the intention here to add only the suggestions that occur to us from a contemplation of the Emeryville specimens. The perforated type has been discussed and in the following discussion we consider only the non-perforated types.

The long delicate forms (1-25463, pl. 53p) in such easily broken material seem to preclude any very rigorous use such as fishing. On the other hand, 1-25487 (pl. 53h), which is of the same type but less than a third as long, would stand very hard treatment. Another

⁹⁶ The lack of vertical distribution data does not permit us to adduce specimens from Stege or Ellis landing in support of either view.

argument against rigorous usage is the shape of the pieces, which is such that it would be very difficult to fasten anything to them which would withstand much wear.

There is definite evidence in this connection. One end of these specimens (always placed toward the top in pl. 53 *q. v.*) is farthest from the center of gravity, is more gradually tapered and less pointed, giving somewhat the appearance of a shank. On account of the fragmentary condition of some specimens we have only fifteen complete examples of this end. In some cases the tip is not further specialized (1-25474, pl. 53*i*); in others it is slightly swelled at the very end (1-25463, pl. 53*p*); and in still others this swelling becomes very definite (1-25488, pl. 53*j*). On eight of the fifteen pieces there still remains on this end of the specimens more or less adhesive material such as asphaltum or pitch extending over a space of from 10 to 20 mm. (1-25473-*c*, pl. 53*g*; or, 1-25485, pl. 53*k*). In this are impressions of cord or twine. Obviously, then, this end was definitely specialized as the end used for attaching the stones to other articles. If the stones were suspended by a cord this end was always uppermost and for purposes of convenience it may accurately be called the top. It will be noted that the drilled end of the perforated pieces is likewise the top. A cord wrapped around 10 to 20 mm. of a tapering stone (or one with a slight button at best) and subjected to the weight of the stone would not withstand very hard usage. It is possible that the stones were placed in a sack or bag of skin the mouth of which was gathered around the top and fastened with a cord. So prepared the fastening would be very secure. The polish of the stones makes such mounting appear improbable. Instead of being suspended by a cord it is possible that the cord bound something to the stone. On one specimen (1-25479) there is an impression in the adhesive material such as might have been made by a feather and this suggests that the stones might have been handles for feather bunches used in dances. Breaks in the cord impression point to its use as a binder. In short, the evidence of fastening seems to eliminate such uses as pestles, sinkers, weaving, or spinning implements, etc., for these plummet-like stones.

The material used offers no conclusive indications of use. The use of a rare material might imply a mystical regard for the pieces. Loud found one piece of actinolite (1-23300) and Uhle one of hematite (1-8925). However Loud's specimen is not a typical specimen⁹⁷

⁹⁷ *Op. cit.*, pl. 19, fig. 8.

and the re-identification which we had made of specimen 1-8925 determines it as one of the Franciscan formations and not hematite. Apparently then the most common raw material was that most ordinarily used and no valuation due to rarity can be attached. In the upper San Joaquin valley the specimens appeared to have been made of material selected for its beauty but of local origin. The material does suggest that whatever the use of the pieces it was well known before the people came to the shellmound.

In discussing workmanship the speculation was advanced that each individual made only one (or very few) such pieces. Such would not appear to be likely if they were intended for a practical purpose. But if a person arriving at a certain stage—physical, emotional, or material—had been allowed to acquire and keep, or use one of these stones in commemoration or celebration of the event, then such a person at such a time would make his piece, and their production would be diverse in quality and limited in quantity. On the other hand stylistic variations might be taken to refute the use of the pieces as charm-stones. If made by many men, it may be claimed that what everybody does is not likely to possess a magical character.

The frequent association of this type of artifact with burials gives no indication of their use since all types of articles were so associated. However, the fact that in some cases, at least, the specimens were "killed" for burial is suggestive. No "killed" ornaments were found by us. This would eliminate the use of plummet-like stones as ornaments.

While the actual reconstruction of specimens from fragments (pl. 53 *m-p*) enabled us to prove "killing" in certain instances, it seems more than probable that a great many other fragments are really due to this custom of "killing." Bancroft as cited by Uhle⁹⁸ interpreted the fact that such stones were usually mutilated as indicating breakage in use and consequently practical uses. It would seem that the "killing" would explain the mutilation as well as the other suggestion.

To sum up: as far as the Emeryville evidence goes it would seem more likely that these pieces were used for ceremonial purposes than for practical ones.

No matter what their original use, a number of pieces offer suggestions of secondary usage. Quite a few are pecked and clipped as though they had been used as hammers, 1-25482, pl. 53*d*). The same piece is worn down at the end as though used as a pestle. Others have their sides flattened as though used as

⁹⁸ *Op. cit.*, 53.

a whetstone or for polishing. No. 1-25473*b* (pl. 53*f*), the granite piece, is a notable example. Modern Indians have shown great superstitious awe of these stones and it seems principally due to such opinions that the pieces came to be regarded as "charmstones."⁹⁹ Hence it may be noted that the very prosaic uses to which these pieces were put by some of the aborigines implies a definite lack of respect and an ignorance of the idea of their having magical qualities.

Rubbing Stones and Whetstones

In both the cone and the trenches fragments were noted which appeared to be parts of stones used for polishing or sharpening. One of these pieces showing a groove, probably from sharpening awls, is shown in plate 54*c* (1-25953). This was from the bottom of the mound in trench 2. Another from nearly as deep in trench 3 is shown in plate 54*b* (1-25955).

The specimen (1-26532) shown in plate 54*k* was probably used as a whetstone.

Sinkers

These articles are remarkable for their absence. Only one specimen, a standstone pebble grooved around the center, was recovered from the entire mound (1-25495, pl. 54*a*). Uhle got one such stone and three of a somewhat similar character. Sinkers were plentiful at West Berkeley, very abundant at Stege, and comparatively scarce at Ellis landing. Since all are made from material readily procurable from any site, this variation in frequency of occurrence must indicate a change of occupation. Considering the nearness of these sites to one another and the absolute absence of any physical bar to communication between them, it seems impossible to suppose that this evidence from the sites can properly be taken to characterize the culture of a people constantly located on the given site. The contemporaneous existence of two (e.g., Stege and Emeryville) markedly different cultures within sight of one another would be very remarkable. Hence we are inclined to take such evidence as characterizing the place rather than the people. Stege was a good place for fishing; Emeryville for shellfish gathering and sea-otter hunting. But the same groups of people may have occupied both sites and engaged in both occupations during the course of their existence.

⁹⁹ However all ethnological data do not point in the same direction. Gifford took some charmstones to Central Miwok Indians in Tuolumne county. The names and uses given by his informants there were as follows:

	Name	Use
Long slender type	Kaiyānā	Fire drill with buckeye hearth
Round type	Hākūnā	To rub deer skins
Perforated type	Hikāani	In spinning

The generic name was lēpīpā. To both Gifford and the author this sounds like manufactured information.

ARTICLES OF STONE (UNWORKED)

Crystals

Associated with each of three burials in the cone were quartz crystals, 1-25449 and 1-25553 (pl. 47 *h-j*). All of these burials were more elaborate than ordinary and the crystals were more or less covered with paint. Uhle recovered a crystal (1-8791, his pl. 2, fig. 9) the base of which had been inlaid with olivella beads on asphaltum. This was also with a burial and 23 feet deep. Ellis landing yielded a considerable number of crystals but generally without data as to depths or associations. Evidently such articles were highly prized and were possibly part of a shaman's equipment. Whether or not they were known during the early history of Emeryville is uncertain, the data being insufficient to warrant a guess.

"Eoliths"

Uhle collected a number of very simple chert fragments (his pls. 6, 1-18) which he considered the handiwork of man. He believed that they were more abundant in the lower part of the mound. This relative abundance connected with the primitive character of the pieces seemed to Uhle evidence of the great antiquity of the mound.

Similar specimens were found by us and on page 175 we have set down the quantity of chert found at the different depths in the trenches. Such figures are not very complete but they seem to show that chert was as abundant in the top part of the trenches as at the bottom. All chert was not in the form of these fragments, but there is so little to distinguish one fragment from another that the total amount seems the best index.

To the writer these pieces show no signs whatsoever of having been retouched. Hammerstones of the same chert were used and it is possible that in such use fragments were knocked off these hammerstones. Beyond this possibility the fragments must be regarded as on a par with the "eoliths" of Europe the non-human occurrence of which is described by Boule.¹⁰⁰ Loud suggests that they are work-shop chips but there are two objections to this. In the first place they do not appear in concentrated form. One cache of several chert pebbles was found, but the fragments seem to be thinly and fairly evenly distri-

¹⁰⁰ M. Boule, *Fossil Men* (English ed., 1923), pp. 111-137.

buted. In the next place only one chipped stone artifact of this material was found (1-25998) whereas there were a number of obsidian pieces. After all, the possible eolithic nature of such pieces seems rather aside from the point for they would not determine the cultural horizon of any area. Where they were found, well-chipped obsidian, inlaid bone beads, mortars, etc., were also found.

Hammerstones

A number of pieces of chert were collected (1-25938-46) which gave evidence of having been used for pounding. Such usage of this chert probably accounts for the small chert chips found and which Uhle thought were eoliths. The chips would be knocked off during the hammering. The vertical distribution of such stones seemed rather uniform beginning at the bottom of the mound. They were particularly noticeable in the trenches although this is probably due to the manner in which we worked.

A lump of greenstone schist of about the right size and weight for a good hammer was recovered from an unknown depth. This is the only piece seen which suggests a groove for lashing on a handle and even here the groove is far from evident. See plate 54*n* (1-26534).

Mica Ornaments

Eight lots of mica ornaments were recovered from the cone. Five of these were actually with burials and it seems probable that all were originally so associated before being disturbed by the shovel. As the burials usually yielded other artifacts, our conclusion is that these articles were of unusual value. The ornaments are in the form of more or less circular discs both drilled and undrilled (1-25539-40, pl. 47 *a-e*, and 1-25538, pl. 47 *f-g*). The drilling is both biconical and from one side. Such pieces were probably pendants. Just how the undrilled discs were used is not clear. There was considerable variation in size—from 25 by 18 mm. to 73 by 45 mm. On account of the nature of the material these specimens have flaked off into a number of pieces. (There are about 100 pieces in the eight lots.) Hence it is difficult to tell the original number actually present. Still a concentration of a number of pieces with a single body is again evident. No such artifacts were recovered from the trenches or from deeper than 20 feet.

Miscellaneous

Here and there among the stone material turned over were noted pebbles or fragments that were possibly artifacts. Some of these were collected and are here commented on although the author is inclined to think that in many cases their inclusion as articles used by the aborigines is more due to selection on our part than on the part of the mound-dwellers.

Pebbles of several sorts were noted. Some were egg-shaped and might have been selected with the intention of using them for sinkers, sling stones (pl. 54j), etc., but nothing actually indicates such use. Several quartz pebbles—much water-worn—seemed rather flattened at one end somewhat as though they had been partly worked into pendants but no such pendants were seen. A large peculiarly shaped chalcedony concretion was noted which might have been of value because of its unusual shape and material (1-25447, pl. 54g). Associated with the burial with the nine charmstones were sixteen pebbles. This association may have been accidental or the pebbles may have had significance. Sometimes it seemed that there was an unusual number of small pebbles or gravel near skulls. This was ordinary water-worn gravel such as found in Temescal creek. Chert pebbles and fragments are dealt with elsewhere. We saw a couple of pebbles shaped like the “snakes’ heads” (1-25439, pl. 47p) found in the upper San Joaquin valley collections. Uhle got a piece which he took to be the effigy of a bird. But since all these pieces are unworked and were not associated with burials their relation to man must remain questionable.

In addition to the fragments elsewhere described which could be recognized as parts of artifacts a few others may be noted. Number 25947 found 25 feet deep had one side stained with red paint when found and might have been an anvil. Flat slabs were noted in the cone which could have been used to cook on. From the bottom of the mound in trench 3 came fragments suggesting a shallow basin or dish.

Paint

Evidences of paint were frequent in the central portion of the mound and in the trenches. Thirty-eight lots were collected, of which three were yellow paint (ferric hydroxide). This was apparently the raw material from which red paint (ferric oxide) was made, for upon being heated and allowed to cool it becomes red. A number of red

pieces suggested this stage in the process of preparation. Other lumps consisted of material apparently ready for use (1-25506, pl. 54*h*). Paint was found on bones and artifacts, in thin layers under burials and elsewhere and in lumps without particular associations.

In the trenches red paint mixed with ash or sand was several times noted extending in a thin layer over a considerable area. One notable example at the depth of 25 feet 3 inches in trench 2 covered about 10 feet of the west end of the trench extending into the surrounding banks (1-26030 is a sample of this material). Under this was a layer of white ash particularly concentrated in spots and above it was charcoal. The skull of skeleton 12-3799 was well imbedded in this layer. A similar layer was observed in the east end of the same trench—at least 10 feet long and at a depth of 29 feet 3 inches. This layer (red paint and charcoal) varied from one-eighth of an inch to one inch in thickness. These layers suggest house floors.

This paint is the ordinary iron oxide used for similar purposes throughout the world. Its presence at a depth of 30 feet (at the clay substratum) and its common use at 29 feet 3 inches for a widespread layer indicate that it was well known in early mound times. Mr. Bennett, chemist of the Sherwin, Williams Paint Co., who kindly examined and tested some of the paint, stated that it occurs commonly throughout the mountains of California. It is usually found in the yellow state. It is to be expected that the raw material would exceed the finished product in quantity whereas the reverse is true. The probability is that it was prepared elsewhere than on the mound—either at the source of supply or at another place of residence.

ARTICLES OF WOOD

No actual artifacts of wood were found. Here and there when skeletons were unearthed the decomposed material suggested wood, but no form could be observed. In places the mound material still bore impressions of posts or poles (1-25546-47). One specimen of (probably) mineralized wood was obtained (1-25556). This was with a skeleton at 20 feet in Area 20 with which were other artifacts. It was not fashioned and was apparently prized because it was unusual.

TEXTILES AND CORDAGE

While, unfortunately, we have but a single piece of direct evidence of the presence of textiles, that piece is a most important one. It comes from the very bottom of the mound (30 feet deep in trench 1) and establishes at once that the people who first came to the site were already familiar with the art of basketry. This specimen (1-25958, pl. 47s) is a small piece of clay bearing the impression of several rows of basketry work, two of which are quite clear for some 20 mm. A positive in wax of this impression is shown in plate 47 *q, r*. Opinions as to technique differ. To the author the basketry appears to be of the coiled type, four and one-half stitches per 10 mm. The large number of awls may be adduced as strengthening this opinion as well as the probability, at least, that the coiled basketry type was made throughout the time the site was occupied.

In Area 28 were found some carbonized fragments indicating cordage and possibly basketry (1-25548). Two cords were detected, both 2-ply. One is about $2\frac{1}{2}$ mm. in diameter, the other about 5 mm. These larger strands may have been worked up into twined basketry. Their relative association suggests this and that a vessel was burned is suggested by a charred material which has protected the cordage and which might have been the asphaltum lining of a basket.

From Area 30, at 10 feet deep, another fragment of carbonized material was recovered. This shows a 2-ply loosely twisted cord about 10 mm. in diameter.

As mentioned in connection with plummet-like stones, some of these stones carry impressions in asphaltum of cords. Not much can be detected from these impressions, but in one case (1-25485) quite a small (not over $\frac{3}{4}$ mm. in diameter) closely twisted cord is indicated.

Whistles also gave evidence of the use of cords.

Although the direct evidence is so slender, not much was to have been expected on account of the fragile and perishable nature of such articles. Suggestions of textiles are found in the arrangement of beads in the form of caps and possibly small capes, in the presence of sinkers for nets, in the many cooking stones, etc. In short, it seems reasonable to suppose that the Emeryville inhabitants always had a knowledge of cordage and basketry, that such things played an important part in their economy, but that no knowledge of higher textile forms was possessed.

SUMMARY

The variety of articles of material culture which the Emeryville mound yielded can best be seen by a glance at the table of contents. An attempt is made in table 12 to characterize some of the principal elements. This is offered as a convenience rather than as a scientific precis. It should not be used without reference to the detailed explanations and qualifications previously recorded.

One is first struck by the evenness of the culture displayed. The abundance of bone work, the quality of ground stone work, the rather limited use of shell, the great scarcity of chipped stone, and the entire absence of pottery characterize all sections of the mound. On a closer view the differences in detail are almost as striking. Not only are no two articles the same but the variation is so great that several types of almost any given article can be observed. These types do not occur in an evolutionary series with the crudest below and the higher forms above. Nor does there appear to be any evidence of stratification in which a given type characterizes all of a certain horizontal section. The differences are rather localized, and this localization or concentration is emphasized by the frequent grouping of several artifacts of a given type in one spot. Such localization suggests the residence of different groups upon the mound. A few types of artifacts do suggest that articles were unknown in the earlier stages of the mound that later came into use, e.g., non-perforated charmstones, stone pipes, mica ornaments, "killed" mortars. On the other hand, such essential elements as basketry, chipped stone implements, shell ornaments, whistles, fishhooks, etc., were known from the earliest times. In short, our data present very little if any evidence of an improvement in the culture of the people during the life of the mound.

An explanation of the conclusion just stated seems necessary. Reviewing the articles of material culture, a number could be found which were noted only above the 17-22-foot level of the mound; while a few types (notably, perforated charmstones) occurred only in the lower portions. In other words there seems considerable evidence that a general cultural change took place at about that level. Both Uhle and Nelson believed that somewhere in the vicinity of this level such a change could be observed. This change would be of primary interest. Why then is the possibility not dwelt on in detail?

The objection is that the evidence only superficially supports the hypothesis. The details of Uhle's material evidence and of his theory

TABLE 12
SUMMARY OF THE MAIN ELEMENTS OF THE MATERIAL CULTURE OF THE EMERYVILLE SHELLMOUND

Articles of	Type	Occurrence	Distribution	Uses	Associations	Remarks
Asphaltum		Plentiful	Throughout	Adhesive	with burials	
Bone		Most abundant	Throughout	Great variety— utilitarian	Generally with Generally not	More used on non-utilitarian objects
	Awls	Very abundant	Throughout		None	Many types
	Fishers	Very abundant	Throughout		None	
	Whistles	Plentiful (grouped)	Throughout		Generally with	Notable aesthetically
Clay		Practically none	—			
European make		None	—			
Horn		Plentiful	Throughout	Utilitarian	Generally not	Composite type
	Fishhooks	Few	More in bottom	—	None	Imply wood working
	Wedges	Plentiful	Throughout	Ornamental	Practically always	
Shell		Plentiful (con- centrated)	Throughout	Ornamental	Practically always	Mostly olivella. Rectangular type not in lower portion.
	Beads	Plentiful (con- centrated)	Throughout	Ornamental	Practically always	Abalone only. Styles localized.
	Discs	Few	Throughout	Ornamental	Practically always	Mostly obsidian. Finds concentrated
Stone (chipped)		Very scarce	Throughout	Weapons	Generally with	Several types: fine workmanship; one ornamented.
Stone (ground)		1 to 7 bodies	Throughout		Generally with	Frequently "killed." Types localized
	Pipes	Very few	None below 17'	Tobacco smoking	Always with	Concentrated. Type—tubular, every pipe different
	Plummet-like (perforated)	Few	Below 20'	Uncertain	None	Steatite. Proto-type of non-perforated?
	Plummet-like (non-perforated)	Fairly plentiful	Mostly above 20'	Ceremonial	Generally with	Concentrated. Several "killed." Top indicated by asphaltum.
Stone (unworked)		1 only	?	Fishing	None	Remarkable for absence. Plentiful in nearby sites.
	Crystals "Tolliths"	Very few	Throughout	Ceremonial	Always with	
	Mica	Very few	Above 20'	Ornamental	Always with	
	Paint	Plentiful	Throughout	Ornamental and	ceremonial	
Wood		None				
Textiles and		Twice	Throughout			Basketry only found
cordage	Textiles Cordage	Plentiful	Throughout			2-ply twist

of change based on a change in the angle of mound material deposition have already been examined in the preceding pages. It seemed to us that the theory depended more on the a priori assumption of its probability than on the evidence adduced. Nelson's views (still in manuscript form) are not so definite. He brings out the possibility of a general level having been established before the cone started to grow and then this general level acting as a catch for much later material which would roll down the sides of the growing cone. It does not seem, however, that the material he actually recovered supports this view or his more important hypothesis that the evidences of material culture if arranged as found from the bottom to the top of the mound will exhibit a series of increasing complexity. Our own evidence supported neither Uhle nor Nelson in detail. Hence its support of the theory of a general cultural change seemed open to question.

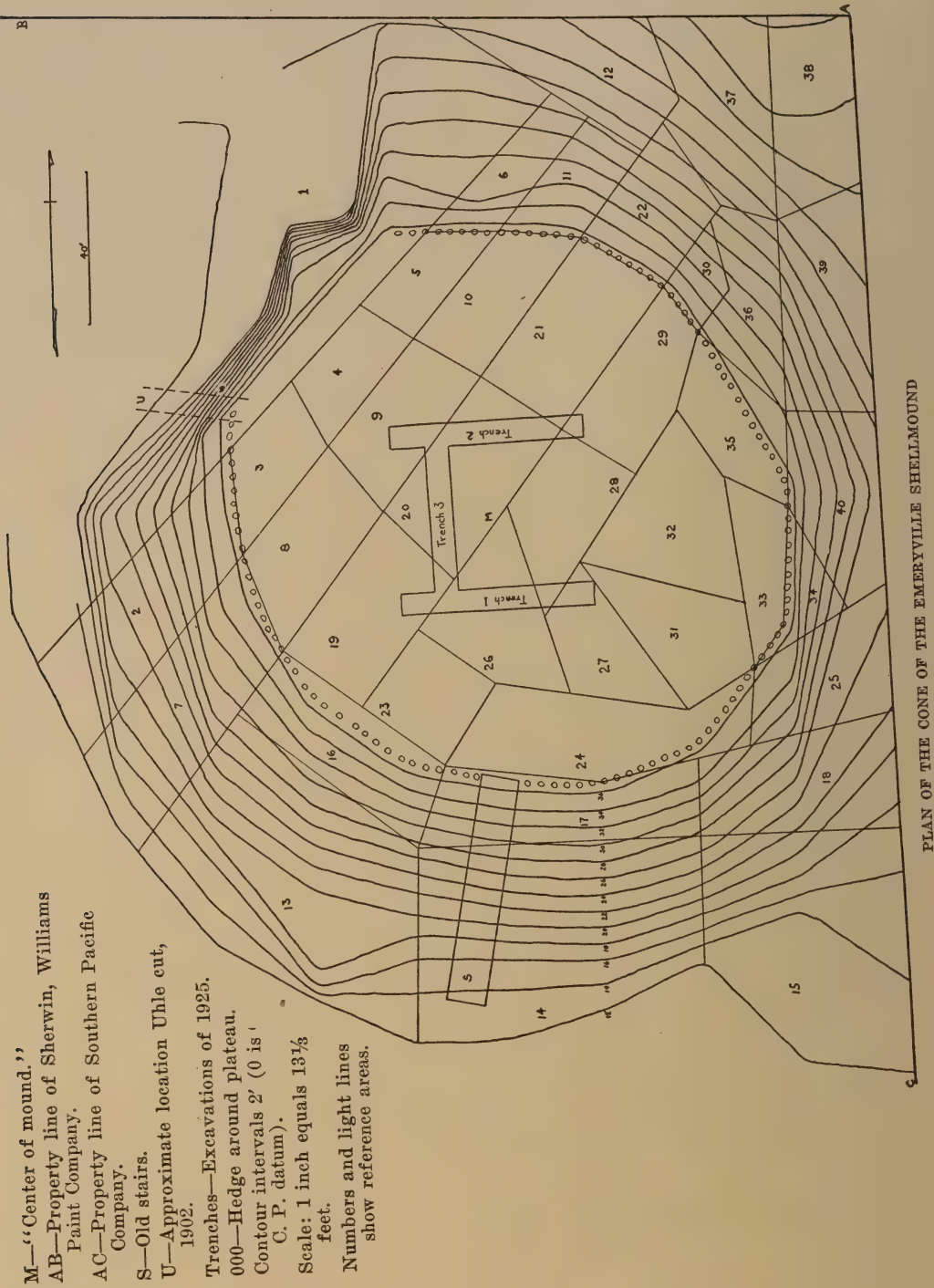
However, the main reason for doubting our own evidence pointing to a general cultural change at the 17-22-foot level is the extraordinary coincidence that the plane of such a change should coincide with the plane at which we changed from steam shovel work to hand work. Below 17-22 feet the material handled was examined with great care, but less than 250 cubic yards were turned over. Above, the emphasis must be placed on the great volume handled—some 26,500 cubic yards. Now if one were dealing with uniform material, increased care might compensate for decreased volume. But when it is recalled how localized the finds were it seems that the two methods are almost certain to give different results which may complement one another on the whole but which cannot be brought together in detail. For example: no pipes were found in the trenches, in the cone six were found. Is it safe to assume that no pipes existed in the lower cultural area until at least 4400 cubic yards of material were handled instead of 250 cubic yards? (4400 plus cubic yards was the average amount of material per pipe in the cone). From the opposite point of view, the intensive trench methods were more likely to disclose the exceptional find. According to evidence actually obtained, basketry was known only at the bottom of the mound. Had our single certain specimen been obtained from a depth of say 16 feet, the trend of speculation would be obvious. In short there appears to be more ground for considering the changes at about the 17-22-foot level as being due to methods of work than to differences of fact.

Finally, is there evidence of a general cultural change even in this plane where a number of differences seem to fall? Neither Uhle nor

Nelson dwell upon the differences discernible in different horizontal areas. A number of such localizations have been mentioned by us. These differences seem as definite and as profound as the changes in different vertical areas. For example: cremation was not noted above 28 feet 7 inches deep, but neither was cremation the only method of disposing of the dead at that level. Rectangular olivella beads were not found below 17 feet deep, but ring type olivella beads were found only in the northwest perimeter. Pipes were not found below 17 feet deep, but three out of five pipes were with one burial. Our conclusion is that to emphasize the vertical differences more than the horizontal ones seems unwarranted. If a theory of occasional visits will account for the horizontal changes, so it will for the similar vertical ones which were observed.

Comparing the material culture with that of other mounds on the east shore of San Francisco bay, one notes an essential similarity. A few differences exist such as the greater use of steatite at Stege and the practical absence of net-sinkers at Emeryville. On the whole, however, these do not seem to be more significant than those differences which can be observed in different parts of a given mound.

Broader comparisons are difficult. Little material for the adjacent regions is available. Yet it seems obvious that an enlargement of our field of comparisons would help to explain some of the differences. For example, the practice of cremation, the use of obsidian, and of porous basalt mortars is limited on our mound. All these traits are more common in the region north of the bay. The delta region yields a greater abundance of shell work and of pipes. The inference which the writer is inclined to draw from this is that groups from those nearby regions were represented from time to time upon the mound. Whether or not such an inference is justified, it is clear that no specific shellmound type of culture existed. The culture indicated is intimately related to that of the surrounding regions. Moreover it is of the low level generally characteristic of the central California Indian at the advent of the white man.



GENERAL SUMMARY

Any connected account of the history of the Emeryville shellmound and its inhabitants must be largely hypothetical. Yet since such accounts have been offered of the shellmounds, an attempt is made to set down by way of summary a brief interpretation of the evidence examined.

ORIGIN AND GROWTH OF THE MOUND

From time to time groups of people from the surrounding country came to the seashore at the mouth of Temescal creek. Their primary purposes in coming were to gather shellfish from the beds existing there and to hunt sea-otter which abounded in the bay. It is probable that they came at that season when these things could be best obtained—not only taking care of their present needs, but drying and pounding up the shellfish for future food supplies and taking the otter skins for clothing.

The first people who came to the site camped just above the shore line, possibly on little hummocks at the edge of the marsh.¹⁰¹ As shellfish were obtained, the shells were thrown aside, and these with the by-products of daily life increased the height of the camp ground and gradually crept out into the marsh where the first shell thrown aside might have been several inches below the water level. As the shell area increased, subsequent people utilized it because it was drier, placing their camps, perhaps, over what had previously been marsh. At the time of the arrival of the first comers the topography of the region was possibly much the same as now. No certain evidence of land subsidence or cataclysmic changes since the beginning of the mound exists. This shell area grew until it covered some hundreds of thousands of square feet marked by several cones, the highest of which was some 30 or 35 feet above the original camp.

CHARACTERISTICS OF THE INHABITANTS

The people who first settled on the Emeryville site were essentially the same as those who last used it. But all the groups who used it were not identical. Indications of the differences exist but the data

¹⁰¹ M. S. Nicol reports that at the West Berkeley shellmound he obtained two skeletons and a number of artifacts at a depth of four and one-half feet under the lowest shell, in the clay substratum.

do not permit an attempt at reconstruction. Taking the mound's inhabitants as a whole, some of their characteristics may be stated.

Fires and basketry were known from the beginning and food was probably cooked in baskets into which hot stones were thrown. Water fowl and deer were plentiful and were freely obtained by means of snares, traps, and wooden weapons rather than by bows and stone-tipped arrows. At the same time the people were able to obtain sea food, hunting the sea-otter, perhaps with balsa rafts. Acorns, seeds, and other vegetable food were used as the plentiful presence of mortars attests. Fish were caught by hook and line but not in nets. Wood was worked with horn wedges and partly wooden shelters of some kind were constructed. Warfare was infrequent since few bodies show signs of having been killed. Obsidian weapons in the mounds suggest that the enemies came from across the bay.

From the time of the first settlers some idea of aesthetic expression existed. Shell was worked into ornaments. Pipes, whistles, mortars, and clothing were decorated with beads. In form, charmstones and pipes indicate an appreciation of line. Whistles were decorated with simple geometric designs as were also abalone discs. Beads were shingled on caps in designs.

That social distinctions existed is indicated by the differences in burial practices. Some bodies were accompanied by many articles; others by none. This was noted even in infant burials. Special groups of objects—pipes, or whistles, or charmstones—with given individuals point to definite social positions or specialization of occupation.

The existence of cults is suggested by objects of a ceremonial nature such as crystals and charmstones. Whistles and the implied music, and possibly dancing point the same way. Considering the existence but scarcity of tobacco pipes it is possible that smoking also was of a ceremonial nature.

Burial was the common method of disposing of the dead but cremation was known. The care used in disposing of the dead varied, but most frequently sufficient attention was given burial to warrant our believing that it was attended with considerable ceremony. Ornaments, if possessed, were buried with the dead, other artifacts frequently. In many cases these were "killed" or broken. The corpse was flexed and possibly placed with the head always toward the sea. Paint was freely used in adorning the body. Shell discs were frequently placed over the eyes, ears, mouth, and other openings of the body. Bodies were not placed in a graveyard although they do seem to have been in groups near the dwelling places.

In short, although we are dealing with a very simple people our evidence all points to an equal level of development in the dwellers on the Emeryville site. A group at a given time differs from that of another time, but the general degree of sophistication attained by the first is equivalent to that of the last. The differences when worked out will permit us to trace cultural relations with adjacent territories rather than to disclose the evolutionary cultural development of one group.

AGE OF THE MOUND

In the above summary, the time element has purposely been left aside. More widespread interest has been shown in this phase of the problem than in any other phase. This warrants our embarking on a discussion that must be speculative.

The absolute age of the mound would be the time of accumulation plus some period equal to the time the mound was not in use. From the skeletal data we have arrived at a time of accumulation (see page 203). The other factor may now be considered.

Was residence on the mound continuous? It has been seen that the skeletal data obtained when considered with reference to the varying rate of mound accumulation seemed to point to non-continuous residence. It has also been noted from the evidences of material culture recovered that whereas no regular or suggestive differences could be discovered in different vertical strata such as might have indicated evolutionary changes due to time, yet localized differences do appear in different portions of the mound—horizontal and vertical. These differences we took to be due to the fact that different groups of people lived on the mound at different times, i.e., residence was non-continuous. The sites of the different mounds themselves suggest non-continuous residence. Stege was a good fishing place; Emeryville a resort for shellfish. In the autumn rains furnished drinking water and wild fowl were plentiful at Ellis landing; but during the winter time it was very exposed and wood was not convenient, while during the summer time drinking water must have been problematical. During such adverse seasons the neighboring hills or river valleys would have offered more protection and food. Our knowledge of the habits of Indians suggests a non-continuous residence on one site. To quote instances of seasonal or periodic shiftings would be tedious, but a couple relating to shellfish may be recalled. Strong has already been quoted to show seasonal visits to places where shellfish could be obtained. Abbott states that "tribes came from long distances to make

autumnal visits to our (Atlantic) sea coast."¹⁰² The Tasmanians¹⁰³ accumulated large shell heaps, and the Australians "immense mounds of shells."¹⁰⁴ As in none of these cases has it been shown that the culture of the shellmounds differed from that of the nearby interior regions, we can only assume that the interior peoples are responsible for the mounds which they accumulated during periodic visits. At Rancho San Antonio del Mar in Baja California, the author has noted shell heaps left by Indians who within the last twenty-five years made seasonal (winter) visits to that spot.

Granted non-continuous residence on the mound sites, we are confronted with the question—how long were they dwelt on each year? Here it seems that one man's guess is as good as another's and guesses would differ for different mounds. Considering the very favorable location at Emeryville, residence there during six months out of each year would not appear unreasonable.

The next unknown factor is the time which may have elapsed due to abandonments of the site for several years. Again only a guess can be advanced, but it seems a speculative possibility that a site as favorable as Emeryville would be occupied, except for seasonal absences, continuously from its first occupation to its final abandonment. Finally there is the time which has elapsed from the mound's final abandonment to the present. There is no evidence as to when Emeryville was left. It was apparently not occupied when Fages passed in 1772, but Indians seem to have been along this shore of the bay, where this is a principal site, after the Spanish arrival. Hence the author would incline to the belief that the site was occupied as long as Indians frequented the east shore of the bay.

On this speculative basis then the author's opinion would lean to the following maximum age for the cone at Emeryville and its immediate base.

Time of accumulation of cone removed.....	215 years
Time of accumulation of estimated base.....	215 years
Addition because residence on the mound was for only 6 months each year.....	430 years
Addition for abandonments and reoccupations.....	0 years
Final abandonment to 1924.....	140 years
Total age.....	1000 years

¹⁰² *Op. cit.*, 16.

¹⁰³ W. J. Sollas, *Ancient Hunters*, 76.

¹⁰⁴ *Ibid.*, 190.

That such an age is not unreasonable seems to be indicated by the archaeological material which shows a remarkable evenness. This has been cited to show the extraordinary stability of culture among the aborigines during a period of three or four thousand years. In view of the fact that such stability is taken as extraordinary, and considering the time of accumulation based on actual data, it seems more reasonable to the author to cite this evenness of culture rather as a proof of a short period of elapsed time for the history of the mound.

While the Emeryville mound may be no older than 500 to 1000 years, and the differences we are able to detect in its culture are not very helpful in determining characteristics of relatively older cultures, it must be remembered that Emeryville is not necessarily the oldest mound of the bay region. The absence of stratification does not eliminate the possibility of the discovery of characteristic differences in different mounds, and of the securing of evidence (e.g., subsidence) of the relative ages of the mound which would enable cultural distinctions due to time to be detected. Awaiting such studies we cannot place man's residence on San Francisco bay at too remote a period.

EXPLANATION OF PLATES

Plate 35. *a.* The Emeryville shellmound in October, 1924; *b.* Southerly wall of Areas 28, 29, and 30.

Plate 36. *a.* Calcined layer on northwest slope; *b.* Cross-section in Areas 8 and 9.

Plate 37. *a.* Heavy ash deposits in Areas 21, 22, 29, 30; *b.* Clamshell lenses in Area 20.

Plate 38. Bone awls; *a-e*, of ulnae—type I; *f-m*, of cannon-bone—type II; *n-q*, of tibiae—type III; *r-s*, of sea-otter penis bone—type V.

<i>a.</i> 1-25735	<i>g.</i> 1-25780	<i>m.</i> 1-25781
<i>b.</i> 1-26081	<i>h.</i> 1-25756	<i>n.</i> 1-25745
<i>c.</i> 1-25737	<i>i.</i> 1-25763	<i>o.</i> 1-25752
<i>d.</i> 1-25739	<i>j.</i> 1-26092	<i>p.</i> 1-25748
<i>e.</i> 1-26079	<i>k.</i> 1-25760	<i>q.</i> 1-25749
<i>f.</i> 1-25764	<i>l.</i> 1-25762	<i>r.</i> 1-26138
		<i>s.</i> 1-26137

Plate 39. Bone awls; *h*, of bird bone—type VI; all others of rib bone—type IV.

<i>a.</i> 1-26134	<i>g.</i> 1-26116	<i>m.</i> 1-26106
<i>b.</i> 1-26135	<i>h.</i> 1-25820	<i>n.</i> 1-26112
<i>c.</i> 1-26131	<i>i.</i> 1-25790	<i>o.</i> 1-25785
<i>d.</i> 1-26122	<i>j.</i> 1-25789	<i>p.</i> 1-26113
<i>e.</i> 1-26129	<i>k.</i> 1-26101	<i>q.</i> 1-25788
<i>f.</i> 1-26123	<i>l.</i> 1-26105	<i>r.</i> 1-25799

Plate 40. Bone fleshers.

<i>a.</i> 1-26069	<i>e.</i> 1-25734	<i>i.</i> 1-25730
<i>b.</i> 1-26073	<i>f.</i> 1-25723	<i>j.</i> 1-25726
<i>c.</i> 1-26073	<i>g.</i> 1-25727	<i>k.</i> 1-25729
<i>d.</i> 1-25733	<i>h.</i> 1-25731	<i>l.</i> 1-25720
		<i>m.</i> 1-25724

Plate 41. Bone tubes and whistles.

<i>a.</i> 1-26188	<i>h.</i> 1-26525	<i>p.</i> 1-25849
<i>b.</i> 1-26189	<i>i.</i> 1-25884	<i>q.</i> 1-25846
<i>c.</i> 1-25872	<i>j.</i> 1-25885	<i>r.</i> 1-25845
<i>d.</i> 1-25865	<i>k.</i> 1-25885	<i>s.</i> 1-25836
<i>e.</i> 1-25880	<i>l.</i> 1-25885	<i>t.</i> 1-25837
<i>f.</i> 1-25881	<i>m.</i> 1-25871	<i>u.</i> 1-25861
<i>g.</i> 1-26466	<i>n.</i> 1-25873	<i>v.</i> 1-25835
	<i>o.</i> 1-25848	<i>w.</i> 1-25855

Plate 42. Bone and horn artifacts.

<i>a.</i> 1-25818	<i>d.</i> 1-25890	<i>g.</i> 1-26194
<i>b.</i> 1-25886	<i>e.</i> 1-26220	<i>h.</i> 1-25897
<i>c.</i> 1-26141	<i>f.</i> 1-26195	<i>i.</i> 1-26208
		<i>j.</i> 1-25891

Plate 43. Bone and horn artifacts; *a-c*, awls of uncertain bone—type VIII; *d*, awl of fish bone—type VII; *e-g*, bone needles; *h-i*, bone pins; *j-p*, bone beads; *q-r*, bone tubes; *s-hp*, fishhook parts; *pd*, horn pendant; *bt*, beaver's tooth; *mb*, drilled astragalus bone.

<i>a.</i> 1-25806	<i>k.</i> 1-26183	<i>u.</i> 1-26172
<i>b.</i> 1-25814	<i>l.</i> 1-26184	<i>v.</i> 1-26173
<i>c.</i> 1-25807	<i>m.</i> 1-26185	<i>w.</i> 1-26175
<i>d.</i> 1-25819	<i>n.</i> 1-26186	<i>x.</i> 1-26177
<i>e.</i> 1-26165	<i>o.</i> 1-25874	<i>y.</i> 1-25909
<i>f.</i> 1-26166	<i>p.</i> 1-25878	<i>z.</i> 1-25907
<i>g.</i> 1-25826	<i>q.</i> 1-25877	<i>fh.</i> 1-26527
<i>h.</i> 1-26162	<i>r.</i> 1-25879	<i>hp.</i> 1-25908
<i>i.</i> 1-26163	<i>s.</i> 1-26170	<i>pd.</i> 1-26196
<i>j.</i> 1-26182	<i>t.</i> 1-26171	<i>bt.</i> 1-25895
		<i>mb.</i> 1-26457

Plate 44. Horn artifacts; *a-g*, wedges; *h*, doubtful; *i*, cup; *j-l*, antler tip pendants; *m*, doubtful.

<i>a.</i> 1-25898	<i>e.</i> 1-26206	<i>i.</i> 1-26219
<i>b.</i> 1-26200	<i>f.</i> 1-26213	<i>j.</i> 1-25906
<i>c.</i> 1-26201	<i>g.</i> 1-26216	<i>k.</i> 1-26528
<i>d.</i> 1-26207	<i>h.</i> 1-26210	<i>l.</i> 1-25905
		<i>m.</i> 1-26470

Plate 45. Shell beads and discs; *a-b*, abalone shell beads; *c*, mussel shell bead; *d-e*, olivella whole shell bead; *f-g*, olivella disc bead; *h-i*, olivella inlay of bushing; *j-k*, olivella bead, ring type; *l-m*, olivella rectangular bead, broad type; *n-o*, olivella rectangular bead, barrow type; *p-q*, miscellaneous ornaments; *r-t*, abalone discs.

<i>a.</i> 1-25616	<i>g.</i> 1-25654	<i>n.</i> 1-25699
<i>b.</i> 1-25616	<i>h.</i> 1-25659	<i>o.</i> 1-25699
<i>c.</i> 1-26053	<i>i.</i> 1-25659	<i>p.</i> 1-25619
<i>d.</i> 1-25628	<i>j.</i> 1-25682	<i>q.</i> 1-25619
<i>e.</i> 1-25628	<i>k.</i> 1-25682	<i>r.</i> 1-25618
<i>f.</i> 1-25654	<i>l.</i> 1-25688	<i>s.</i> 1-25598
	<i>m.</i> 1-25688	<i>t.</i> 1-25610

Plate 46. Abalone shell pendants.

<i>a.</i> 1-25557	<i>h.</i> 1-25571	<i>o.</i> 1-25587
<i>b.</i> 1-26036	<i>i.</i> 1-25576	<i>p.</i> 1-25592
<i>c.</i> 1-25568	<i>j.</i> 1-25577	<i>q.</i> 1-26044
<i>d.</i> 1-25563	<i>k.</i> 1-25579	<i>r.</i> 1-25595
<i>e.</i> 1-25570	<i>l.</i> 1-25579	<i>s.</i> 1-25595
<i>f.</i> 1-25570	<i>m.</i> 1-25587	<i>t.</i> 1-26038
<i>g.</i> 1-25571	<i>n.</i> 1-25587	<i>u.</i> 1-26051

Plate 47. Pendants, crystals, basketry; *a-g*, mica pendants; *h-j*, quartz crystals; *k-o*, abalone shell pendants; *p*, "snake's head"; *q-s*, basketry evidence.

<i>a.</i> 1-25539	<i>g.</i> 1-25538	<i>m.</i> 1-25585
<i>b.</i> 1-25539	<i>h.</i> 1-25449	<i>n.</i> 1-25585
<i>c.</i> 1-25539	<i>i.</i> 1-25553	<i>o.</i> 1-25584
<i>d.</i> 1-25540	<i>j.</i> 1-25553	<i>p.</i> 1-25439
<i>e.</i> 1-25540	<i>k.</i> 1-25580	<i>q.</i> 1-25958*
<i>f.</i> 1-25538	<i>l.</i> 1-25596	<i>r.</i> 1-25958*
		<i>s.</i> 1-25958

* Wax impression of.

Plate 48. Chipped stone points. All are of obsidian except *k*, which is of mottled flint; *p*, which is gray chalcedony; and *q*, which is greenish chert.

<i>a.</i> 1-25505	<i>f.</i> 1-25456	<i>l.</i> 1-26004
<i>b.</i> 1-26006	<i>g.</i> 1-25457	<i>m.</i> 1-26001
<i>c.</i> 1-26010	<i>h.</i> 1-25451	<i>n.</i> 1-26007
<i>d.</i> 1-25452	<i>i.</i> 1-25460	<i>o.</i> 1-26011
<i>e.</i> 1-25455	<i>j.</i> 1-26000	<i>p.</i> 1-25450
	<i>k.</i> 1-25997	<i>q.</i> 1-25998

Plate 49. Stone mortars; *a*, type V; *b*, type I.

<i>a.</i> 1-25349	<i>b.</i> 1-25323
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Plate 50. Stone mortars; *a*, type II; *b*, type III; *c*, type IV.

<i>a.</i> 1-25531	<i>b.</i> 1-25337	<i>c.</i> 1-25343
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Plate 51. Pestles.

<i>a.</i> 1-25412. Type III.	<i>c.</i> 1-25380. Type II.
<i>b.</i> 1-25376. Type I.	<i>d.</i> 1-25420. Type IV.

Plate 52. Pipes and plugs; *a-c*, pipes; *d, g*, plugs; *e, f*, pipes.

<i>a.</i> 1-25503	<i>d.</i> 1-25497	<i>f.</i> 1-25498
<i>b.</i> 1-25501	<i>e.</i> 1-25499	<i>g.</i> 1-25496
<i>c.</i> 1-25500		

Plate 53. Plummet-like stones and (or) charmstones.

<i>a.</i> 1-26012	<i>f.</i> 1-25473b	<i>k.</i> 1-25485
<i>b.</i> 1-26013	<i>g.</i> 1-25473c	<i>l.</i> 1-25481
<i>c.</i> 1-26015	<i>h.</i> 1-25487	<i>m.</i> 1-25464
<i>d.</i> 1-25482	<i>i.</i> 1-25474	<i>n.</i> 1-25465
<i>e.</i> 1-25476	<i>j.</i> 1-25488	<i>o.</i> 1-25466
		<i>p.</i> 1-25463

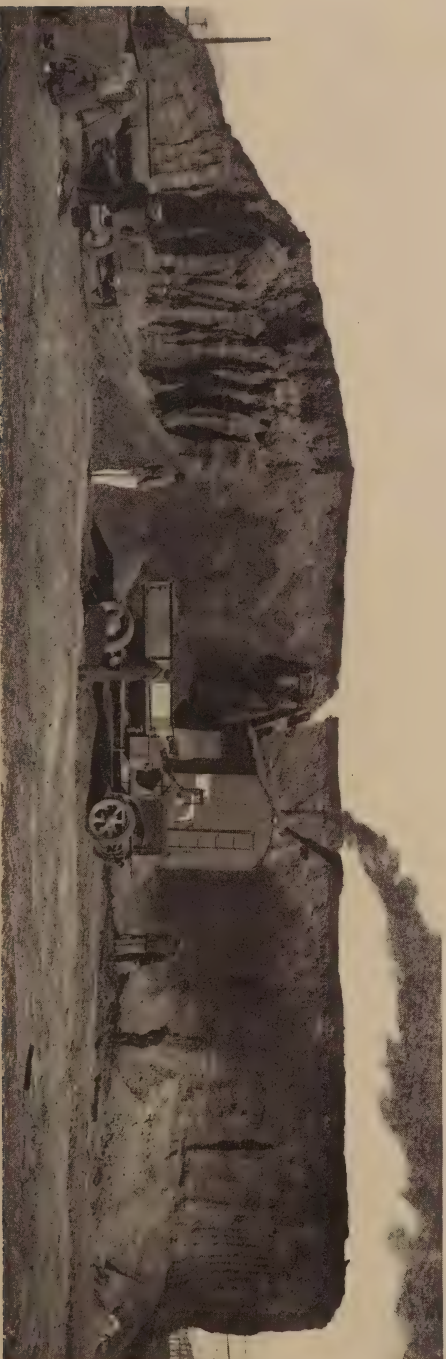
Plate 54. Miscellaneous mineral pieces. *a*, sinker; *b-c*, sharpening stones; *d-f*, baked clay; *g*, chalcedony concretion; *h*, "red paint"; *i*, obsidian pebble; *j*, round pebble; *k*, whetstone; *l*, doubtful; *m*, paint mortar; *n*, greenstone schist pestle.

<i>a.</i> 1-25495	<i>e.</i> 1-25959	<i>j.</i> 1-26541
<i>b.</i> 1-25955	<i>f.</i> 1-25960	<i>k.</i> 1-26532
<i>c.</i> 1-25953	<i>g.</i> 1-25447	<i>l.</i> 1-25436
<i>d.</i> 1-25543	<i>h.</i> 1-25506	<i>m.</i> 1-25914
	<i>i.</i> 1-25461	<i>n.</i> 1-26534

PLATES 35-54



d. THE EMERYVILLE MOUND IN OCTOBER, 1924



b. SOUTHERLY WALL OF AREAS 28, 29, AND 30



a. CALCINED LAYERS ON NORTHWESTERN SLOPE



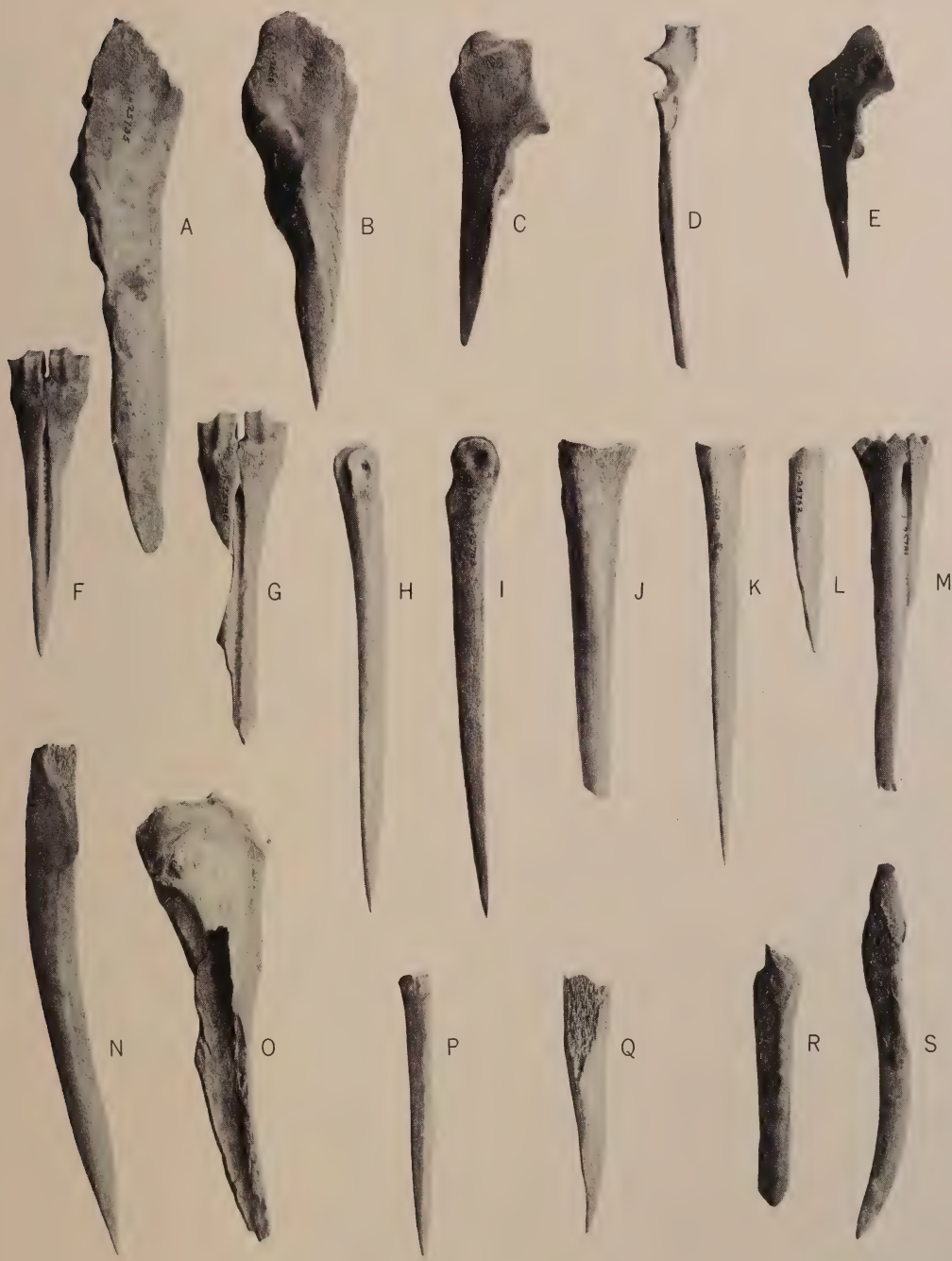
b. CROSS-SECTION IN AREAS 8 AND 9



a. HEAVY ASH DEPOSIT IN AREAS 21, 22, 29, AND 30



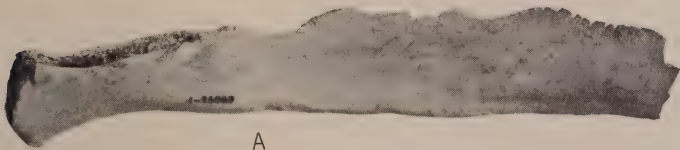
b. CLAMSHELL LENSES IN AREA 20



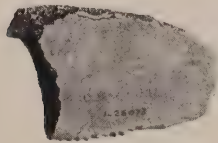
BONE AWLS



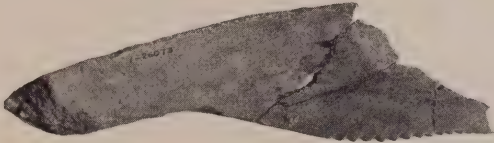
BONE AWLS



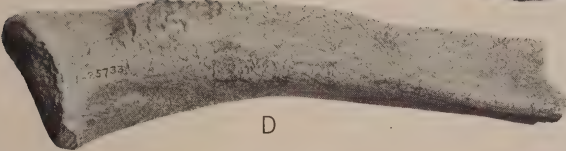
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B



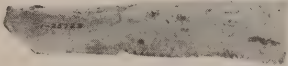
C



D



E



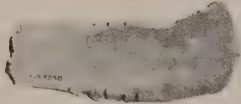
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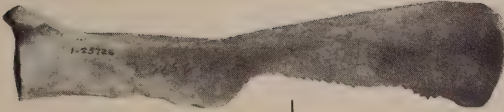
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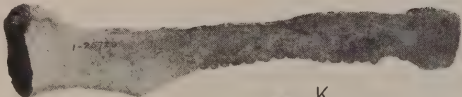
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I



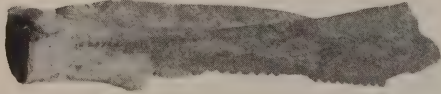
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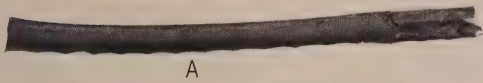


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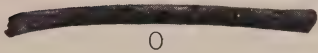


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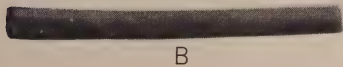
BONE FLESHERS



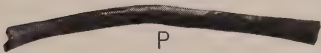
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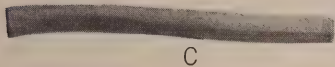
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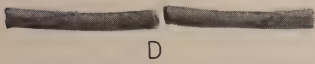
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P



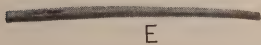
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Q



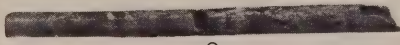
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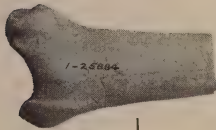
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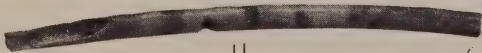
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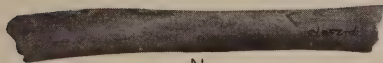
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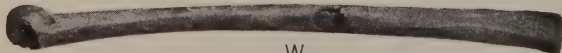
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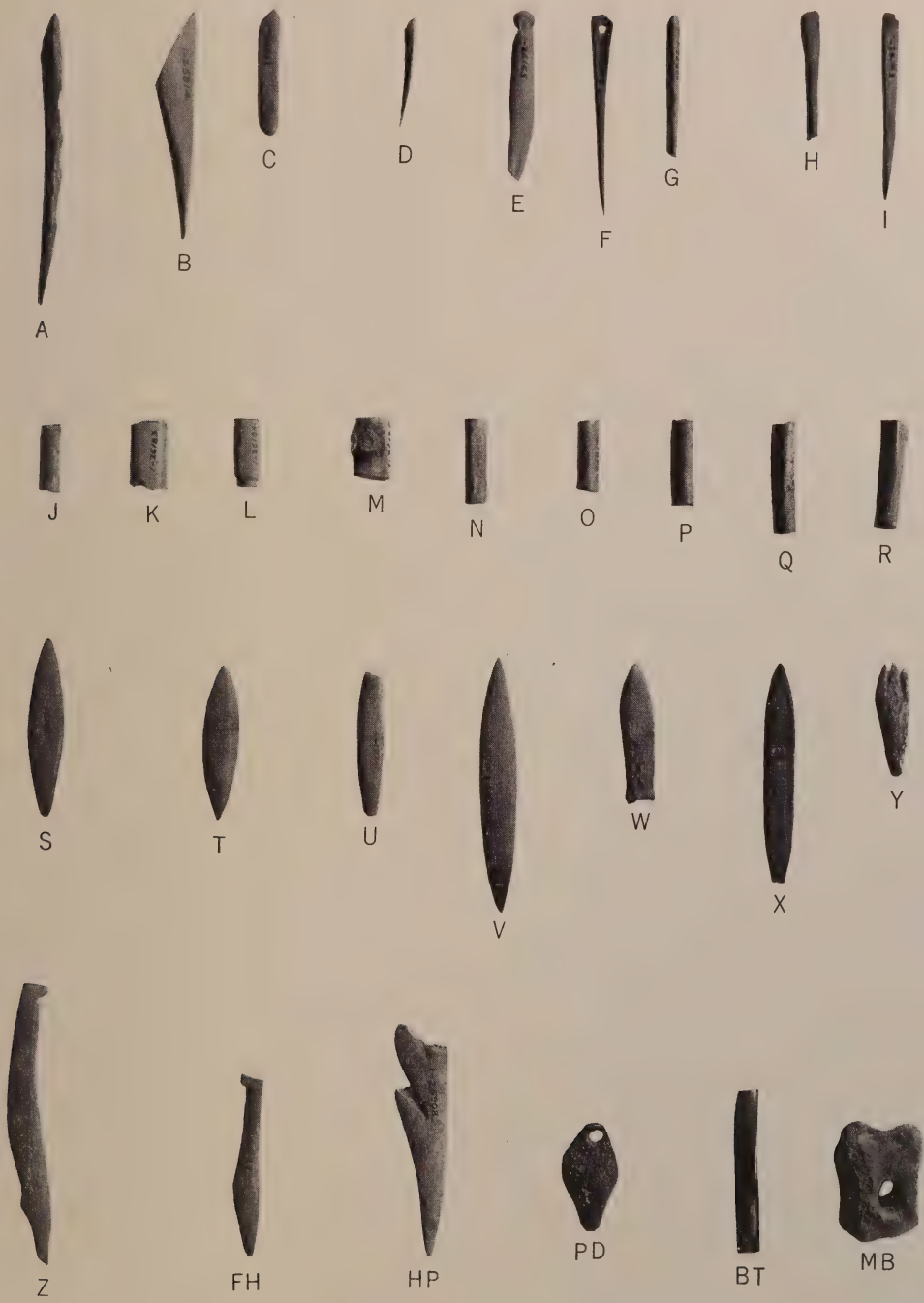


W

BONE TUBES AND WHISTLES



BONE AND HORN ARTIFACTS



BONE AND HORN ARTIFACTS



A



B



C



D



E



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H



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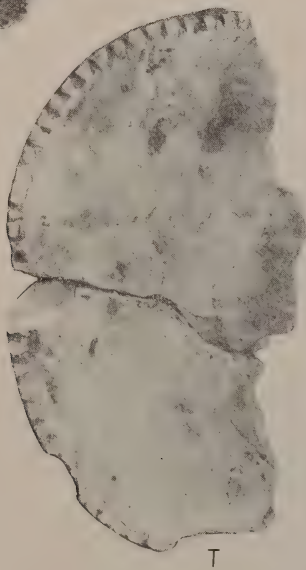
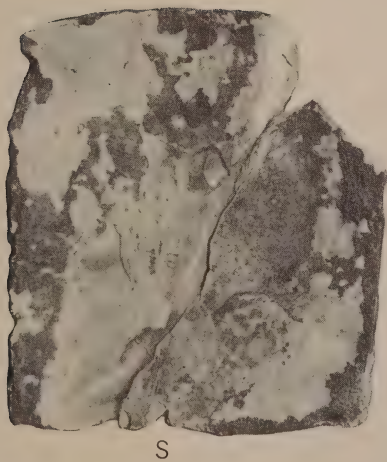
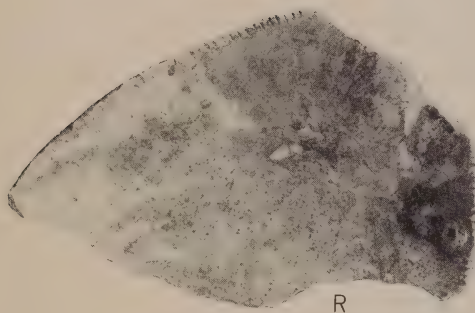
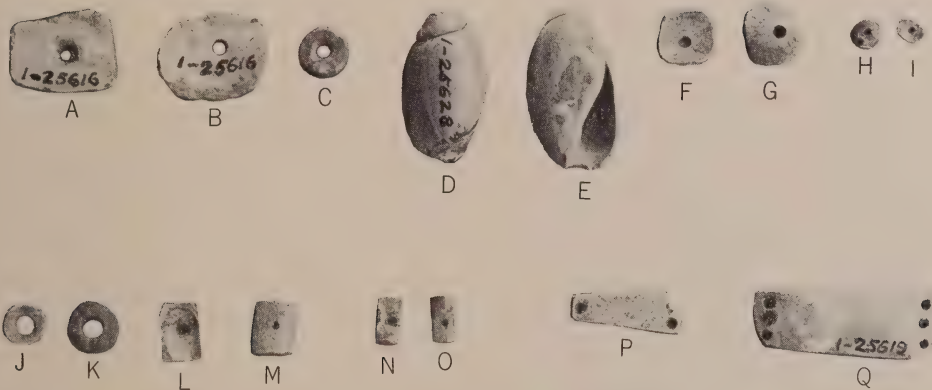


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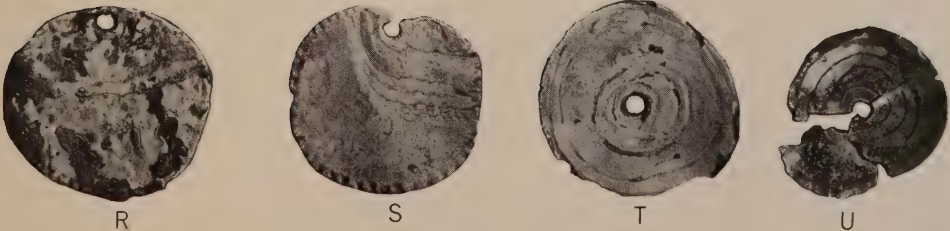


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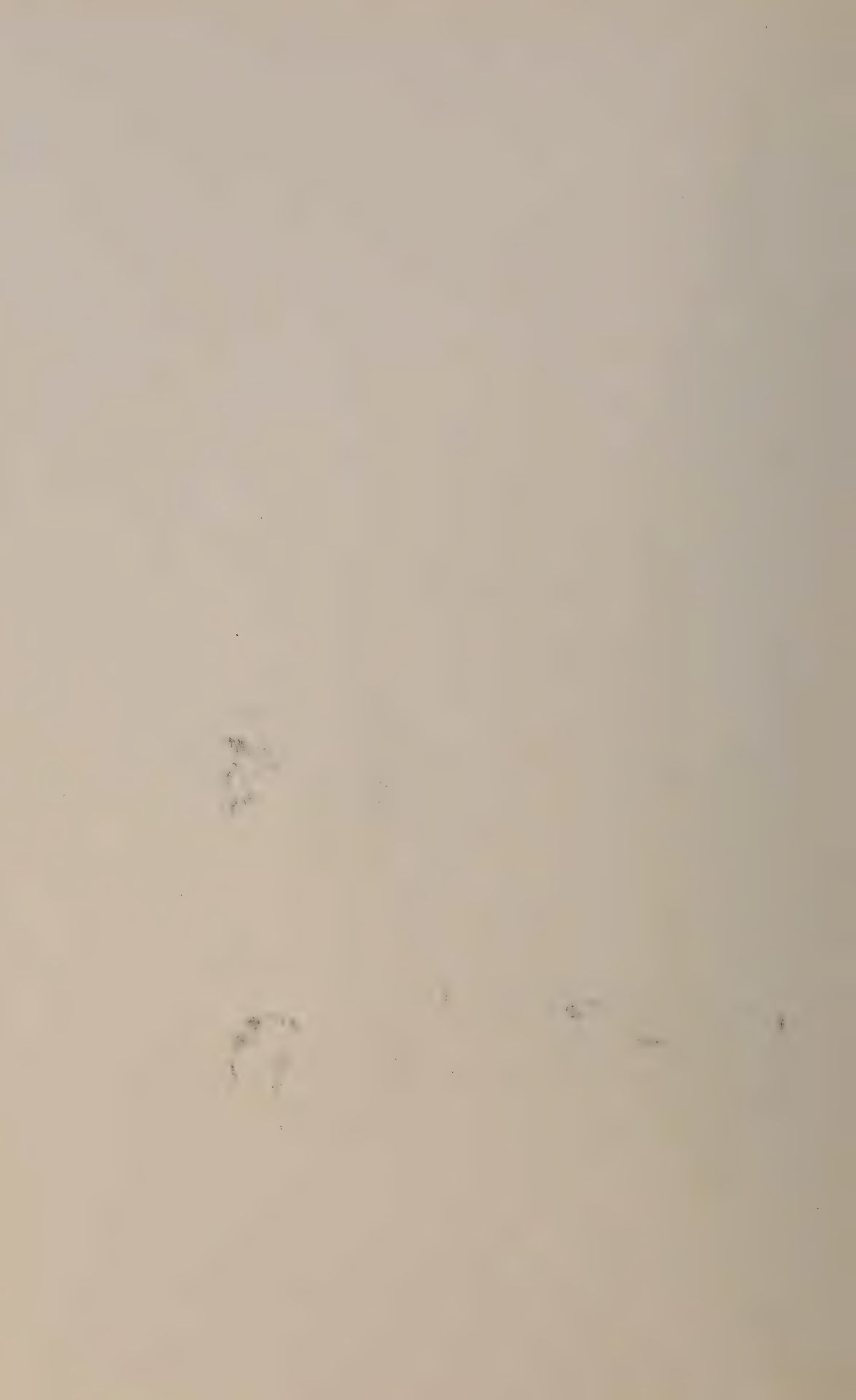
HORN ARTIFACTS



SHELL BEADS AND DISCS



ABALONE SHELL PENDANTS





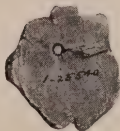
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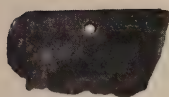
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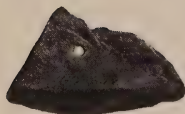
D



E



F



G



H



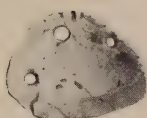
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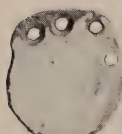
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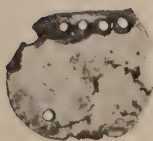
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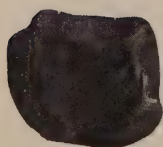
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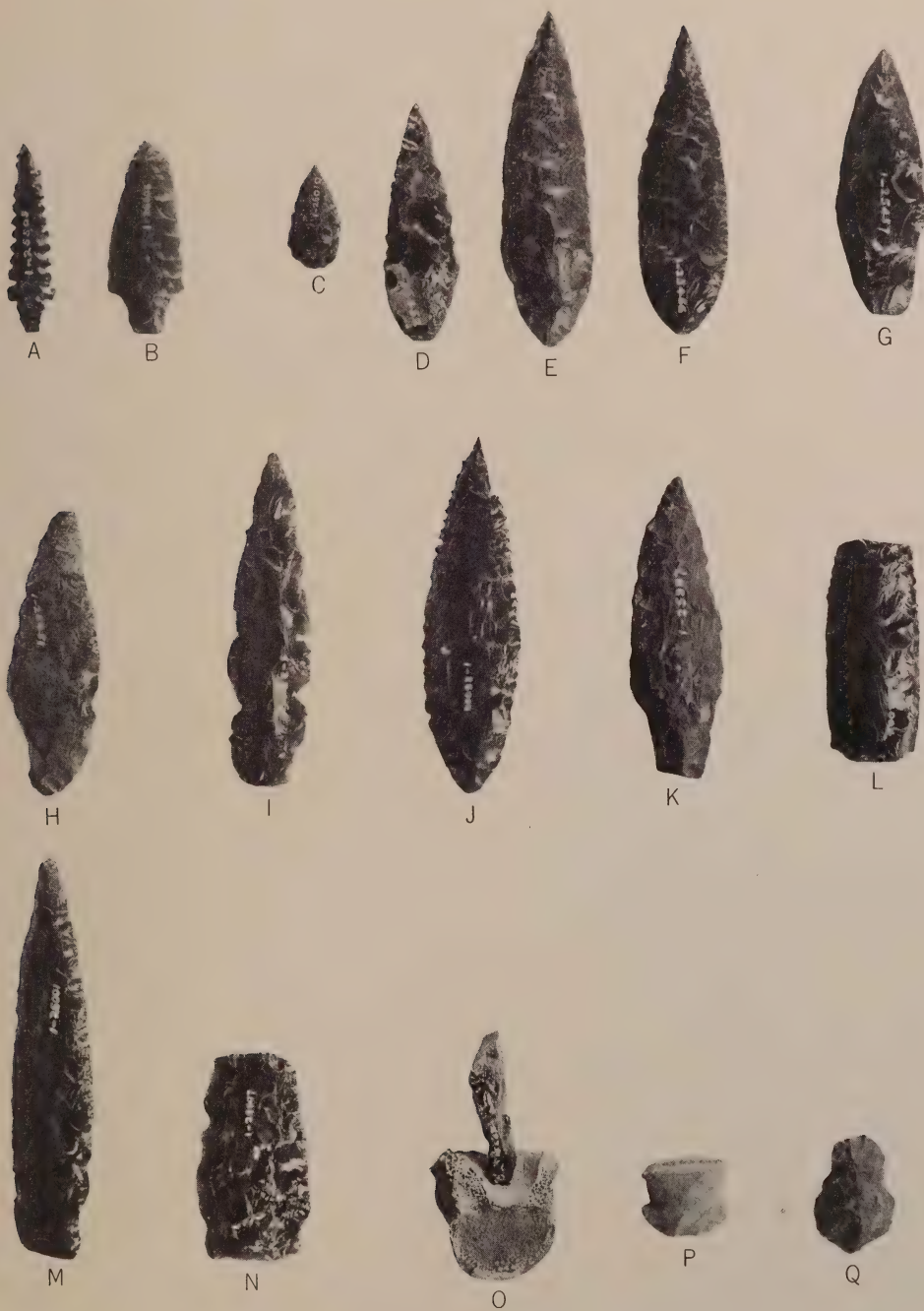
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R



S



CHIPPED STONE POINTS

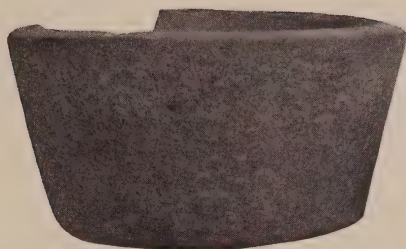


A

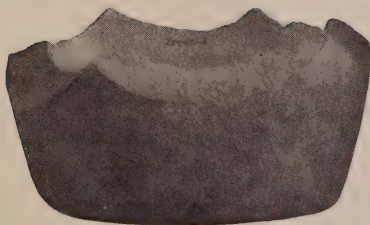


B

STONE MORTARS



A



B



C

STONE MORTARS



A



B

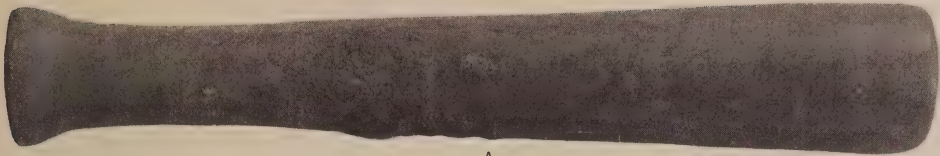


C

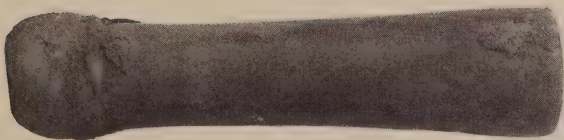


D

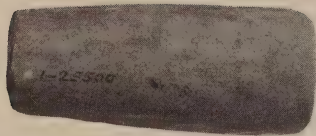
PESTLES



A



B



C



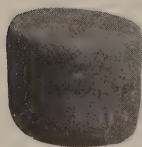
D



E



F



G

PIPES AND PLUGS



PLUMMET-LIKE STONES



A



B



C



D



E



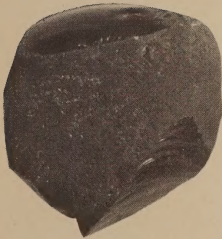
F



G



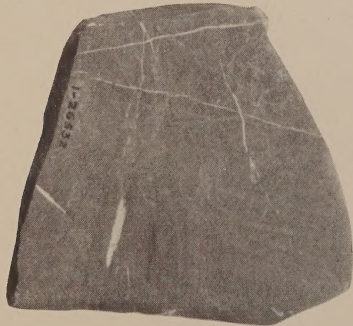
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I



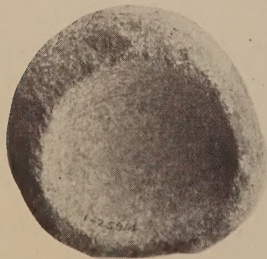
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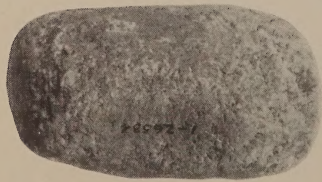
K



L



M



N

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